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Editor: C. W. Winders, B.Sc.Agr.

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Brucellosis-Tested Swine Herds (As at 31st July, 1956).

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M. Nielsen, "Cressbrook" Stud, Goomburra
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"Wattledale Stud," 492 Beenleigh road, Sunnybank.
Kruger and Sons, "Greyhurst," Goombungee
A. Scott, "Wanstead" Stud, Grantham

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H. W. Naumann, "Parkdale" Stud, Kalbar

Tuberculosis-Free Cattle Herds.

The studs listed below have fulfilled the conditions of the Department's Tuberculosis-free Herd Scheme to 31st July, 1956.

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	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
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	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
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	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
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	Mrs. K. Henry, Greenmount
	D. B. Green, "Deloraine" Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
	A. H. Webster, "Millievale," Derrymore
	W. H. Sanderson, "Sunlit Farm," Mulgildie
	R. A. and N. K. Shelton, "Vuegon" A.I.S. Stud, Hivesville, via Murgon
	R. R. Radel & Sons, "Happy Valley," Coalstoun Lakes
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
	D. J. Pender, "Camelot," Lytton road, Lindum
	S. E. G. Macdonald, "Freshfields," Marburg
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
	G. L. Johnson, "Old Cannindah," Monto
	A. Ruge & Sons, Woowoonga, *via* Biggenden
	G. Miller, Armagh Guernsey Stud, Armagh, M.S. 428 Grantham
Jersey	Queensland Agricultural High School and College, Lawes
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	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
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	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
	W. C M. Birt, "Pine Hill" Jersey Stud, Gundiah
	T. Nock, Dallarnil
	P. Fowler & Sons, "Northlea," Coalstoun Lakes
	F. Porter, Conondale
	H.M. State Farm, Palen Creek
Poll Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

Bunch Covers for Bananas

By F. W. BERRILL, Horticulturist.

Every banana grower aims to produce first quality fruit at a time when market prices are high. The Lady Finger variety usually commands a reasonable price throughout the year, but in the case of the dwarf and semi-dwarf varieties, such as Cavendish and Mons Mari, the best prices are generally obtained for bunches which are thrown between January and March. Such bunches must necessarily hang in the plantation through the autumn and at least part of the winter until the fruit reaches maturity.

EFFECT OF WINTER CONDITIONS.

The banana is essentially a tropical plant and in southern Queensland the growth rate slows down during winter. This is, of course, reflected in the development of the bunch.

Low temperatures produce two more or less distinct effects on the plant. The slowing down of the growth rate limits the movement of nutrients and water from the corm into the developing bunch. As a result the potential weight of the bunch at harvesting is reduced. The second effect is confined to the bunch itself. The fingers do not fill out normally and, particularly if soil moisture is low, may commence to colour before they are fully mature. The hands nearest to the plant usually fill better than those further down the stalk, while the fruit on the front of the bunch is generally better than that at the back. Thus the bunch tends to taper from end to end and from front to back.

In addition to their effect on fruit filling, low temperatures, particularly if accompanied by wind, may produce superficial skin blemishes, the most common of these being blotching and spotting. These are sometimes severe enough to blacken the exposed sides of the fingers. The term "winter blemish" is usually applied to any disfiguration caused by low temperatures, and although only skin deep it detracts considerably from the market appearance of the fruit.

USE OF PROTECTIVE COVERS.

Many years ago, it was observed that when winter bunches were covered with hessian or some similar material, fruit development was more uniform and the fingers were much less angular when harvested. The cover also protected the developing fruit from chilling winds, the abrasive action of dead leaves and damage by birds, so a more attractive product could be marketed. The advantages of the practice were soon appreciated and covers have since been used on a fairly extensive scale.

Fertilizer Bags.

The earliest type of cover was the standard fertilizer bag slit open along the bottom. For use on large bunches, the bags had also to be cut along one side. This type of cover was fitted as an apron over the sides of the bunch and was fastened at the top and bottom with pieces of wire or nails.

Fertilizer bags used as bunch covers must be thoroughly washed, since only very small quantities of fertilizer adhering to the fabric will burn the tender skin of the fruit.

With the apron type of cover, the bunch can be examined much more easily than bunches enclosed under a complete "sleeve."

Hessian Covers.

Covers made from clean, new hessian (Plate 1) are usually more durable than those made from fertilizer bags.

Hessian may be obtained in various grades, the specifications of which are

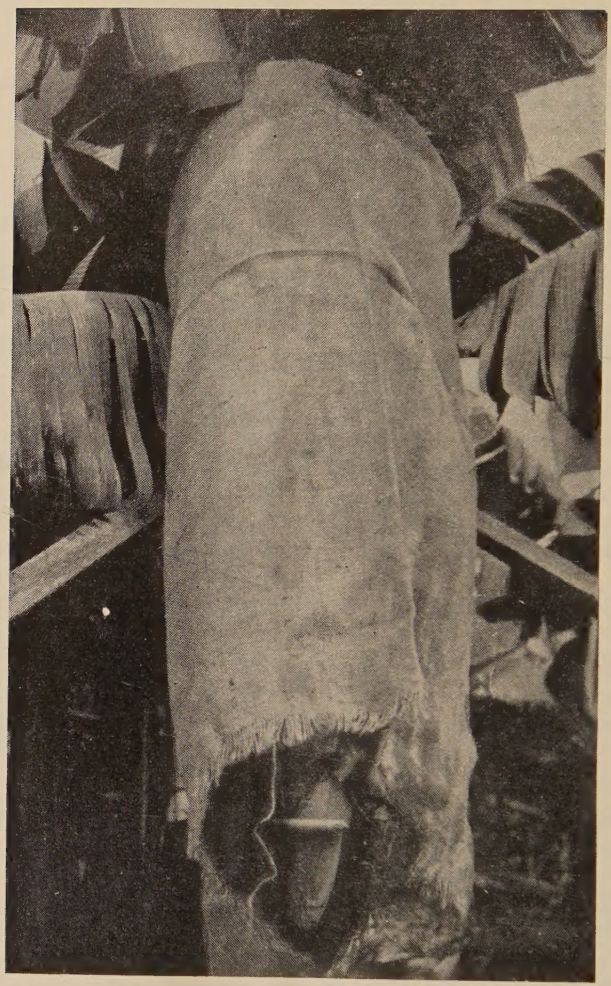

Plate 1.

Cavendish Bunch with Hessian Cover in Position.

usually related to the degree of porosity. The type used for the manufacture of sugar bags is one of the finer grades but the pore size is rather small for banana bunch covers. At the other end of the scale is the type with a very open mesh which is used for onion bags. The hessian preferred for covers is one of the intermediate grades (7½ oz. or 18 oz.). These grades of hessian are usually available in 60 in. and 72 in. widths and can be conveniently cut and folded to make covers 30 in. or 36 in. wide according to requirements. It is not necessary for the cover to be sewn up the back, but if it is left open care should be taken to secure the top and bottom so that it cannot be blown up over the bunch.

Alternatively, ready-made sewn hessian sleeves may be purchased, but these are slightly more costly.

Substitutes for Hessian.

When hessian has been in short supply or highly priced, other materials have been tested as substitutes. Some commercial products based on tarred paper with a hessian reinforcement, though very durable, are liable to cause some abrasion of the fruit, particularly during windy

weather. Brown paper covers and plastic covers are two other possibilities.

Brown Paper Covers.

Heavy grade brown paper sleeves were introduced some time ago as a cheap substitute for hessian covers. They are usually manufactured by sewing together two sheets of paper 30 in. wide and approximately 38 in. long.

Their durability is far from good. The points of attachment with either wire or nails at the throat of the bunch and the area in contact with the ends of the fingers on the first hand are weaknesses, particularly in wet weather. Intermittent showers with light winds are even more destructive to this type of cover than continuous rain. In well sheltered situations, however, the lack of durability may not be of major importance.

Plastic Covers.

During recent years, there has been considerable interest in the possibility of using plastic bunch covers (Plate 2). These covers are made up in the form of sleeves which are open at both ends but the hem at one

Plate 2.

Cavendish Bunch Fitted with Plastic Cover. Note the protection afforded by the overhanging leaves.

end is provided with a drawstring to simplify attachment to the bunch stalk. A range of colours is available. The material is fairly durable and is not affected by the insecticides and fungicides commonly used in the plantations for pest and disease control.

Following the introduction of these covers, field experiments were carried out in southern Queensland to assess their value. Winter ratoon bunches of Cavendish, Mons Mari and Lady Finger bananas have been used, the covers tested being blue, green, yellow, clear, or red in colour. It has been found that under favourable conditions, all plastic covers irrespective of colour are capable of increasing bunch weight by as much as 10 per cent. This increase is due to the greater weight of the individual fingers. The usual difference in fruit filling between the upper and lower hands of uncovered bunches is considerably reduced, as is the variation between the front and back, so the bunch presents a much more uniform appearance.

The external appearance of the fruit under plastic covers is outstandingly superior to that of unprotected bunches. The skin is a somewhat lighter-green in colour and softer in texture, while characteristic winter blemishes are eliminated. Internal fruit quality and palatability are unaffected. The plastic covers also accelerate the rate of bunch development, so that the fruit is harvested approximately a fortnight earlier than uncovered bunches thrown at the same time.

The principal disadvantage of plastic covers is the susceptibility of the fruit to sunburn. Whenever the bunch is not sheltered by overhanging leaves and the plastic cover is exposed to direct sunlight, burning of the fruit is likely to occur. The damage is usually worst on the first and second hands, which are often the most valuable from an economic point of view. Such damage may outweigh the overall improvement in bunch weight and fruit quality resulting from the use of the cover.

In the case of Lady Finger and other tall varieties of banana, the bunch is usually much more exposed than in the Cavendish and Mons Mari and the risk of sunburn in these varieties is generally such as to preclude the use of plastic covers.

Comparison of Hessian and Plastic Covers.

Both hessian and plastic covers will protect the developing bunch from skin blemishes and considerably improve the appearance and the quality of the fruit. They increase the final bunch weight by virtue of the better filling of the individual fingers, plastic covers usually being superior to hessian covers in this respect.

Both types of cover are simple to fit and the materials are fairly durable. Each cover may be used at least three times and probably more, depending on weather conditions.

Plastic covers tend to accelerate bunch maturity by up to a fortnight, whereas the hessian covers have comparatively little effect.

The use of a plastic cover on a bunch which is not well protected by overhanging leaves is likely to result in fruit losses due to sunburn, whereas hessian is quite safe in this respect.

TIME OF COVERING.

The period during which bunch covers should be used in the plantation varies somewhat from one district to another and is also influenced by the aspect of the plantation. In general, they should be fitted to all hanging bunches just prior to the onset of winter, which is usually some time in April in southern Queensland, and also to bunches thrown during the winter months. Bunches may be covered at any age, but in newly thrown bunches it is generally preferable to wait until the last fruit bract has lifted (Plate 3). The young fingers have then hardened off somewhat before the cover is fitted and are less likely to suffer injury from rubbing.

When using hessian or other opaque covers, it is an advantage to brand them with a distinctive mark as they are fitted. This may take the form of a coloured paint mark, a number, a letter or all three. By this means, the grower can see at a glance the date on which the bunch was thrown and a considerable amount of time is saved in subsequent harvesting operations.

HARVESTING.

Irrespective of what type of cover is used, the skin of the fruit at harvesting is rather softer than normal. For this reason, every care should be taken to avoid bruising during harvesting operations.

It is good policy to leave the cover in position until the bunch reaches the packing shed, and then to allow the fruit to remain uncovered for at least 24 hours before it is handled. Where this procedure is adopted, the amount of bruising during subsequent packing and transport is reduced appreciably.

At no time should a bunch which was previously covered be exposed to direct sunlight, as the fruit may be scalded.

Plate 3.

Young Cavendish Bunch in Which the Last Fruit Bract has been Open for about Three Days. This is a suitable stage at which to fit a cover.

Notes on Tropical Cyclones.

In a recent brochure on tropical cyclones and flood warnings, the Commonwealth Bureau of Meteorology gave the following description of a tropical cyclone which will be of interest to people in the coastal areas particularly.

"The most important danger signal is the combination of falling atmospheric pressure (barometric reading) and the wind holding south-east with increasing speed or tending more easterly.

In the sky there are initially some cirrus clouds (high white feathery shapes) which rapidly thicken and change to cirrostratus like a tangled web through which a coloured ring (halo) may be seen around the sun or moon. Along with steadily increasing wind speed from the south-east or east, clouds thicken into a dense, darker and lower mass called altostratus, through which the moon is pale and the sun watery.

The atmosphere becomes close and oppressive, the barometer reading falls more rapidly, the wind becomes squally or blows in short gusts and soon drizzling rain begins to fall. As the centre approaches, the rain becomes much heavier, even falling in torrents, and the wind blows from gale to hurricane force with fearful squalls. As the centre passes to the southward along the coast, the wind changes to the south and south-west, skies clear, and all is over.

Sometimes the very centre of the cyclone may pass over the land, in which case there is a sudden lull in the wind and then it blows strongly from the opposite quarter—westerly instead of easterly. Heavy rain falls again for a while but soon ceases as the cyclone passes on. This calm centre of the cyclone is known as the eye.

When over the ocean, a typical cyclone may be said to consist of three parts—the eye, the core and the periphery.

The eye may vary from 5 to 40 miles in diameter. The sky is mainly clear of cloud but around the edge the cloud builds up like a mighty wall to a height of 20,000 to 40,000 ft. The sea surface within the eye, however, is violently confused by wave motion caused by the inward circulating winds from the core, although within the eye the wind is practically calm.

The core extends from the wall of the eye outward for a distance up to 200 miles or more in most directions and is the region of extensive cloud, heavy rains and winds from hurricane force inside to gale force at the outer edge of the core.

Beyond the core lies the periphery, which changes from the almost clear sky of the outer edge to overcast with drizzle or light rain and gradually increasing wind speed.

Usually the most intense winds and rain are found in what is called the left-hand side and in particular the front left-hand quadrant if one were facing the direction of the movement of the cyclone.

The coastline and adjacent mountains assist the uplift of air and also cause turbulence in the wind, so that as a cyclone moves southward along the coast here is a much greater contrast between the weather on the southern or approaching side than on the northern or retreating side of the cyclone, the change from intense rain to clear skies being sometimes very abrupt as the wind swings from east to west."

Trifoliata Rootstocks for Citrus

By A. A. ROSS, Horticulturist.

Until comparatively recent times, orchardists in Queensland have shown little interest in the types of rootstocks used for propagating citrus, and the majority of the trees in commercial orchards are established on citronelle (rough lemon) stocks. This is an ideal stock from a nurseryman's point of view as it grows rapidly, produces vigorous trees, develops a straight stem with few side shoots and buds easily.

Orchardists were for long quite satisfied with the early performance of trees on citronelle stock and many have yet to be convinced that it can be surpassed. Under certain conditions, however, citronelle stock has some defects. Perhaps the greatest of these is its susceptibility to brown rot gummosis, a root disease caused by the fungus *Phytophthora citrophthora*, which becomes particularly troublesome where sub-surface drainage is poor. In addition to this, mandarin varieties on citronelle stock react severely to the viruses which cause tree decline and often become unprofitable at an early age. All rootstocks exert a profound influence on fruit quality, and in this respect citronelle is distinctly inferior to sweet orange, sour orange and trifoliata orange.

Current interest in trifoliata rootstocks for citrus is largely due to their high resistance to root rots.

Description of the Plant.

The botanical name of the trifoliata orange is *Poncirus trifoliata*. The term *trifoliata* indicates that the leaf is three-lobed and not single-lobed as in the true citrus species. The plant is, however, sufficiently closely related to the genus *Citrus* to permit the grafting of citrus species onto it. Hybridisation between the two groups is also practicable, although the progeny are mostly sterile. The native habitat of the plant is Central and Southern China, but it is now distributed throughout the world.

The trifoliata plant develops into a large much-branched shrub which is armed with stout thorns and bears dark-green, three-lobed leaves. The fruits are about the size of a golf ball, densely covered with short hairs, a dull lemon colour when ripe, and somewhat fragrant. The seeds are ovoid, plump and very numerous. The plant is deciduous in habit and can therefore withstand much lower winter temperatures than the true citrus fruits.

Desirable Characteristics.

As a rootstock, trifoliata is especially adapted for use on reasonably fertile, heavy-textured soils where other stocks may fail, but it nevertheless appreciates favourable conditions and responds to good cultural treatment. It cannot be expected to thrive on poorly drained or infertile land which is inherently unsuitable for citrus.

Experience with trifoliata has shown that it possesses many desirable stock characters in addition to its resistance to root diseases. Trees grown on it produce fruit of excellent quality with a fine, smooth rind and a low percentage of rag. The juice has a pleasing balance between acids and sugar and its aromatic content is comparatively high. Citrus fruits

from trees grown on citronelle stock tend to develop in their juice a bitter principle called limonin which becomes most noticeable on processing. Fruit from trees on trifoliata stock does not develop this substance to anything like the same extent, and this character, linked with its otherwise superior juice quality, makes it very desirable for processing purposes.

Trifoliata produces a well-branched root system with an abundance of fibrous roots which are very sensitive to drying. Young trees on this stock must therefore be handled with care to avoid damage when they are transplanted. Because of its free rooting habit and resistance to root diseases, the stock performs well in replant land provided the soil is generally suitable for citrus culture.

Nursery Behaviour.

In the nursery, trifoliata stocks are fairly vigorous but less so than citronelle. Seeds germinate well and develop into sturdy seedlings among which there are comparatively few bench-rooted plants. Approximately 70 per cent. of the seedlings are of nucellar origin (that is, they develop from vegetative buds in the ovary) and the plants are therefore remarkably uniform in size and vigour. The seedlings are very thorny, and for comfort in working should be budded

Plate 1.

Union of Lemon on Trifoliata Stock Showing Typical Symptoms of Scaly-butt. Budwood propagated on trifoliata stock must be free from the scaly-butt virus.

at an early age, when the buds take well. The amount of attention required by the budlings is not excessive. Both seedlings and budlings are very resistant to cold temperatures.

Reaction to Scaly-Butt Virus.

The main objection to trifoliata rootstocks for citrus is their reaction to scaly-butt virus, known also as exocortis, in the scion bud (Plate 1). This virus though widely distributed does not produce any apparent symptoms in trees worked on citronelle and sweet orange stocks. However, dwarfing and lack of vigour accompanied by a scaly condition of the bark below the union are frequently encountered in trees worked on trifoliata stock. In commercial practice, citrus varieties should only be budded onto trifoliata stock when the parent trees are known to be free from the disease.

At present, only a limited number of trees are known to be free of the scaly-butt virus. Suitable budwood for propagation is therefore in very short supply and is restricted to the Valencia Late and Washington Navel orange varieties. Any budwood of other orange varieties must be classed as doubtful. A large proportion of lemon and grapefruit trees also carry the virus and it is therefore undesirable to use trifoliata stock for

Plate 2.

Union of Emperor on Trifoliata Stock. The stock has over-grown the Emperor scion but the effect on cropping has yet to be determined.

either of these two species. The mandarin varieties grown in Queensland have not been thoroughly tested for scaly-butt virus and may be less generally infected than the lemon. Nevertheless, until healthy mature trees of these varieties on trifoliata stock become available as sources of budwood, a certain amount of risk is involved in propagating them on this particular stock.

Other Factors.

There are certain other distinctive features in trifoliata stocks. The union of the worked tree frequently becomes overgrown—that is, the stock is larger than the scion (Plate 2). This may or may not affect the cropping capacity of the tree, although present indications are that it has no adverse effect. Another characteristic which may prove important is the tendency of this stock to accentuate granulation in the fruit of varieties which are already subject to the trouble; this may be a strain characteristic which can be removed by selection.

Citrus trees worked on trifoliata stock are unusually precocious and bear heavy crops at an early age. It is therefore necessary to remove the fruit from young trees in order to allow them to gain reasonable size before they settle down to consistent cropping.

The experience already gained with trifoliata as a rootstock indicates that it is adapted to only a restricted range of conditions. It may prove of value where other stocks fail, although it is not likely to be wholly satisfactory in warm climates.

Conclusions.

Much still remains to be learnt about citrus rootstocks and about trifoliata stock in particular. At this juncture, commercial plantings of citrus trees on trifoliata cannot be recommended indiscriminately.

Trees propagated from buds taken from parent trees which are known to be free from scaly-butt virus should prove satisfactory, but at present the number of such trees is limited and these are restricted to Washington Navel and Valencia oranges. Lemons and grapefruit varieties, for the most part, will probably be unsuitable on trifoliata rootstock and the mandarins are doubtful propositions.

Future prospects for trifoliata as a rootstock for oranges and possibly mandarins appear bright. Nevertheless, experimental work must first establish its credentials in detail and sources of disease-free budwood must be located before its commercial use can be recommended.

TESTING OF DIPPING SOLUTIONS.

Stock-owners are advised that dip samples for testing should in future be sent to Biochemist, Animal Research Institute, Yeerongpilly, instead of to the Agricultural Chemist, Roma Street, as in the past. The address given may be used for both posted and railed samples.

Marketing Facilities for Fruit and Vegetables in Cities Overseas

By H. S. HUNTER, Director of Marketing.

INTRODUCTION.

The purpose of this report is to indicate the major problems which are being encountered in some other parts of the world in providing suitable facilities for the marketing of fruit and vegetables and to examine the various ways in which these problems are being surmounted. From observation it would appear that marketing problems are basically similar wherever markets exist, and while the approach to marketing may vary somewhat from one country to another a good deal can be learnt from an examination of similar problems in their different settings.

Attention will be given chiefly to marketing facilities in North America because the existing methods and development pattern of produce marketing in Australia show more affinity to Canada and the United States than elsewhere. Also the difficulties which have to be overcome in this country already have received attention in North America with what appears to be a fair amount of success.

One of the principal lessons to be learnt from the American scene is that before adopting measures designed to remedy faults and deficiencies in the fruit and vegetable markets of any particular city, it is first essential to thoroughly investigate the marketing functions necessary for the city and the producers who supply it in order to clarify the problem and to take cognisance of the needs of the various interests involved in the whole marketing process.

Location in the geographical centre of population is considered an important factor. The cost of the land must be taken into consideration and the topography of the land is important. Comprehensive reports of some of the surveys made by the United States Department of Agriculture have been made available and these reports provide a very useful guide to the form of market research which has been adopted by specialists in this field of enquiry after many years of experience.

The officer of the United States Department of Agriculture who might be described as the chief specialist in market location and design, Mr. W. C. Crow, has acquired high prestige amongst market managers and market operators (merchant agents) throughout North America. He has performed or assisted in surveys and the planning of layout and design for fruit and vegetable markets for many cities, including Boston, Columbia (South Carolina), Atlanta (Georgia), Louisville (Kentucky), Indianapolis (Indiana), Columbus (Ohio) and Philadelphia in the United States, and he was consulted in respect of a new market for Toronto, Canada. Mr. Crow is Chief of the Transportation

and Facilities Branch of the Marketing Research Division, Agricultural Marketing Service, U.S.D.A. Much of the information on which this report is based was obtained from him or his assistant, Mr. Geo. Turner.

SUMMARY.

The main points revealed by the investigation may be summarised as follows:—

(1) An economic survey of the trade and transport and an estimation of the costs involved should precede the relocation of a market.

(2) The function of wholesale markets for fruit and vegetables in the future should be assessed, as far as may be possible, in the light of modern retailing trends of prepackaged goods through supermarkets and self service chain stores.

(3) Relocation should not be decided upon in the absence of support of the interests concerned with the market.

(4) A splitting of the market should be avoided.

(5) The land should be level and adequate in area for immediate needs for trading, the parking of vehicles and future expansion.

(6) The establishment of a new market should be associated with an amortization plan under which it would pay for itself over a specified period of years.

MARKET PROBLEMS.

The growth of modern cities with their large industrially employed populations, combined with developments in road motor transportation, has rendered central city markets, in many cases, quite inadequate for the task imposed upon them.

Very often the central or terminal market, because of restricted space, had been unable to expand as the city grew, or to adapt itself to the motor transportation which has replaced the horse-drawn vehicle for which it was originally designed.

All of the capital cities of eastern Australia—Sydney, Melbourne and Brisbane—have a problem which has brought forth proposals for the removal of their fruit and vegetable markets from their present locations to larger locations less congested with non-market traffic near the city. So also in North America the same problems confront many of the cities and in some instances remedies have been or are about to be applied.

The location of the city market is in some cases quite unsuitable, not only because of the lack of space for sellers but also because proper parking facilities for buyers' vehicles cannot be provided except at very high cost, and the purchase of adequate space in such locations would be uneconomical.

In numerous instances, public markets originated as retail centres to enable producers from nearby farms to sell their produce direct to city consumers. These markets have grown into wholesale markets where the major proportion of sales is to city retailers and secondary wholesalers, who in turn supply the needs of consumers of the city and outside

points. In some cases the wholesale markets may now be considered regional markets because they draw produce from an extensive supply area to meet the needs of consumers in a number of centres of population.

There is much evidence in overseas markets that the development of facilities has often been quite haphazard. One of the common faults associated with the piecemeal addition is the scattering of physical facilities in several different locations, causing a "split" market. The split or divided market is now regarded by marketing authorities throughout the world as one of the major drawbacks to efficient marketing.

The disadvantage of split markets seemed to be more acute in the U.S.A. and Canada than elsewhere, a position no doubt caused by rapid expansion in population and production over the last 50 years. In those countries the split usually involved such groups as wholesale dealers, local farmers and truckers. The producers' market, when removed from the main marketing centre, usually lacked vitality, partly because of the lack of volume and variety in its offerings and the inability of the local producers to maintain a continuity of supply. However, generally speaking, the main disadvantages are the crosshauling of a large volume of produce, the additional time and distance buyers have to travel, and the difficulty of comparing prices and quality, thereby reducing the effectiveness of supply and demand. With regard to the latter, the team surveying the Boston market facilities found that wide variations and fluctuations in both price and supply could be attributed to incomplete information about supply and demand associated with split markets. They went on to state that "the more complete is this information, the more accurately will price be established and the more readily will the produce be moved into market channels."

Recent developments in the transport field have aggravated marketing problems, and with the modern tendency to provide "one stop" service for buyers who come to the market, the importance of concentration markets is now universally recognised.

It is evident that to some extent the main terminal markets are being by-passed by new kinds of marketing channels. While there are many factors behind this change, the development of efficient long-haul trucking is one of the most important. The present terminal markets are losing business because they are too often inadequate for trucks, the streets being too narrow and congested. The pressing need to make markets more attractive for trucking operations has brought the general inefficiency and outdatedness of most of the country's larger markets into sharper focus.

According to the U.S.D.A. publication "Marketing Activities" for the month of December, 1954—

> "Present indications are that motor-truck movement of these products (fruit and vegetables) during 1954 will exceed 1953 slightly. Best information now available provides a general estimate that at least half of the fresh fruit and vegetables moving in wholesale commercial channels go to market via motor truck. There are some reliable sources that believe this proportion is 55 to 60 per cent."

MEETING THE PROBLEM.

With expert opinion so definite in its condemnation of the provision of additional market facilities in a location removed from the existing market area, it would seem that the course of action most likely to succeed is either to completely remodel the existing market or to relocate it.

On the surface, remodelling the market in its present position appears to have certain advantages in that it is the established trading place and the use of existing facilities materially reduces the number of new ones that must be constructed. However, in practice it seldom offers a real solution because additional space generally is not available except by purchase at prohibitive prices and costly demolition; moreover, remodelling would not necessarily correct the traffic situation. In any case, before a decision can be made, a thorough survey of existing facilities is essential in order to measure their deficiencies and to form estimates of both current requirements and the likely needs for future expansion.

The type of investigation conducted by U.S.D.A. in the United States and by the Canadian Department of Agriculture in Canada is an exhaustive volume and value survey of all produce moving through the marketing area. The scope of the survey is generally restricted to a 12 months' period, as recent as possible without being unduly disturbed by episodic events.

The method of investigation for most of the surveys was personal interview of all interested parties. These included a large percentage of farmers doing business on the market, all known wholesale dealers, trade organisations, railroad companies and city officials. Co-operation from the various groups was on a voluntary basis but interest was such that there were very few cases where detailed records were not made available to the investigating authority. Where the field of investigation was too large to make a complete cover practical, sampling was resorted to.

Arrangement of Data.

Initially the data obtained are assembled so as to indicate the physical volume of produce moving into the market area. This information is classified according to origin, mode of transport, month of arrival and receiving agencies. Then follows a more detailed examination of data pertaining to local deliveries which are classified in terms of ton-mile units according to the direction from which entry to the marketing area is made.

Data relating to distribution are generally arranged to show the volume sales through such channels as local retail, local cafes and institutions, country order trade and intermarket transactions. Another avenue which has figured prominently in produce distribution in the U.S.A. in recent years is the chain store organisation, and the above classifications are sometimes adjusted to show the operations of this group.

The summary of existing facilities requires a survey of the various marketing agencies to assemble data regarding the number of buildings, floor and storage space, railroad capacity and parking space. Other items

for which statistical information is tabulated include traffic flow with reference to such factors as market and non-market vehicles, and marketing costs with particular regard to labour, cartage and time factors.

Treatment of Data.

From an analysis of the classified data, the defects of the existing market facilities can be expressed in fairly precise terms. Moreover, the analysis can then be directed towards providing answers to the following questions—

(1) What kind of market is needed to correct the defects?
(2) What types of facilities are necessary to develop the kind of of market needed?
(3) How should these facilities be designed and arranged?
(4) How many facilities of each type are needed?
(5) What is the estimated cost of such facilities?
(6) How much land would be required?
(7) Where should the market be located?

However, before these questions are examined it is important first to ascertain that there will be sufficient support for the establishment of a new market. There is a maxim that the construction of facilities alone will not create a market. It will be appreciated that if a new facility were built and used by only a small percentage of the trade, the market would be further split and many of the economic advantages of the new facility would thus be lost.

To draw once again on American experience, it has been found that where markets are established in different locations, there is a tendency for business to desert the weaker for the stronger, and up to the point where the facilities of the stronger market are being fully used. Therefore, it would be reasonable to base plans for a new market upon the total volume and flow of commodities revealed by the survey. At the same time, the willingness of the various trade groups, etc., to use the new facilities must be sufficient to warrant rebuilding.

In the initial planning, provision should be made for future expansion and possibly the inclusion of facilities for dealers in related commodities who might some day want to locate in the market area. However, much emphasis has been placed on the need to make sure that a new market is not overbuilt at the start. The usual recommendation of investigating committees in the United States has been that initial construction be confined to facilities for which satisfactory leases have previously been obtained, but the mistake must not be made of failing to secure sufficient land to permit of the expansion of the market in future years.

Provided these further considerations are taken into account, the answers to many of the questions raised above will be obtained from an examination of the data obtained during the survey. Points for further discussion comprise provision and arrangement of facilities, land requirements and location.

Provision and Arrangement of Facilities.

In addition to the selling floors and offices, provision should be made in the plans for (1) rail connections right to the market, (2) a parking area for motor vehicles, and (3) public restrooms, a restaurant and related facilities.

To operate most efficiently, the facilities must be so grouped as to expedite the physical movement of commodities and yet ensure a high degree of concentration of supply and demand. Also, they should be so arranged in relation to space reserved for future expansion as to ensure all similar units being constructed in the same section of the markets in the event of additional units being needed.

Plate 1.

Layout of a Newly Constructed Market (Columbia, S.C.).

The width of market streets will depend upon the size of vehicles using them, given that a constant flow of traffic should be provided for. Recent recommendations are that major streets should be about 140 ft. in width to permit centre parking, backing of trucks at right angles to the loading platforms, and one lane of traffic in each direction. With parallel parking, the width could be decreased to 100 ft. Where no parking is permitted, streets could be 60 feet in width. The desirable distance between rail tracks is about 80 ft.

Once again, it might be mentioned that sufficient parking space is an important item in the planning of a market. An interesting recommendation made with respect to centre parking in the main streets

of the Indianapolis market was that it should be angular, at about 65 degrees. This would make it easier for trucks to pull in and back out of the parking spaces, and if truck lengths should increase in coming years the angle of parking could be decreased, thereby leaving more space for traffic movement.

Plate 2.

Buyers' Vehicles at a Newly Constructed Market (Toronto).

SOME NORTH AMERICAN CASES.

In the following selection of North American cities the problems posed by obsolete wholesale fruit and vegetable markets have produced a variety of reactions.

San Francisco.

In San Francisco, including the city of Oakland just across the bay, there is a population of approximately four million people. This population supports two markets, one at Oakland and one in San Francisco proper. There is currently an agitation for the removal of the San Francisco market from its present location, bounded by the bay and the financial centre of the city, to a location at Hunter Point on the outskirts of the city. The old market, whilst out-of-date in many respects, was nevertheless well laid out originally and well served by several streets. Although at peak hours some of the produce is stacked on the footpaths and in some side streets, congestion is not as serious as in many other towns. Many of the larger operators are resisting the proposals for removal of the markets. They base their opposition on their contention that removal is not necessary in the interests of their industry or of the consumers. They are not prepared to agree to the loss which they would suffer if removal is really, as they suspect, to enable the now congested financial centre of the city to expand on to the old market site.

Los Angeles.

Los Angeles is a large city with rapidly expanding industrial capacity and activity. Much of this expansion has been encouraged by the petroliferous oil and oil refining industry. It is an important aircraft manufacturing centre. With adjacent Hollywood, Los Angeles has a population of four million people. There are two fruit and vegetable (including cut flowers) markets centrally situated about one mile apart and well served by private streets and rail communication. The two markets are governed by the one Market Agents' Association. In this way the markets have combined so well that they are practically one market. The markets, which are owned by the Southern Pacific Railroad Company, have replaced an old market in an adjacent location which was owned by a Company formed by the agents who operated in it. What is left of the latter market is now put to a variety of miscellaneous uses, including storage of fruit, fruit cases and fertilizer.

An up-to-date market has been constructed, complete with wide concreted roadways and parking spaces, by the competing Santa Fe Railroad Co. about six miles out from the centre of the city adjacent to that Company's railway line. But this market has not attracted the agents and merchants to leave the more centrally situated market, which in any event does not suffer seriously from congestion of traffic or overcrowding of operators. Thus the Santa Fe market, now some years old, is used only for storage space and must represent a heavy loss to the builders.

The business done in the Los Angeles market is not confined to the requirements of the large local population, but it is a clearing house for produce which is railed to the eastern States and other distant centres. Flowers are exported from Los Angeles to buyers in Europe.

The market in current use is mainly, but not entirely, without loading platforms, and consequently a great deal of produce has to be lifted for purposes of unloading from and loading on to road vehicles. Experiments are being conducted there with costly hydraulically operated platforms by means of which vehicles are lowered below ground level until their floors are flush with the ground, as an alternative to the use of fork-lift trucks.

Kansas City.

Kansas City, a twin town partly in Missouri and partly in Kansas, provides another illustration of the futility of building a second market without having the full co-operation of all interests concerned. The twin cities already had a good market in Missouri, but another market has been erected with Railroad backing in Kansas. The latter, as is the case with the Santa Fe Railway Market at Los Angeles, is not used

Chicago.

Chicago in 1925 built a new market (the South Water Street market) at a cost of 17 million dollars, but according to Mr. Crow they made a mistake by locating it about 1¼ miles away from the railway terminal for fruit and vegetables which was constructed at the same time. This was admitted to the writer as being a mistake by both the Market Master at the South Water Street Market and the Manager

of the Rail Terminal for fruit and vegetables. The rail terminal, owned by Sante Fe Railroad, is located on an area of 74 acres with 50 miles of railroad tracks. Of over 3,000 car loads received there in 1953, only 31 per cent. went into Chicago; the remainder were redirected to other towns.

Detroit.

Detroit, a city of 25 miles in diameter, with the fringes going beyond this zone, agreed after five years of investigation and discussion to move its market from a small location in the centre of the city to a new location five miles from the centre.

Columbia.

Columbia (South Carolina) has a market recently erected after consultation with the United States Department of Agriculture, which was described to the writer by Departmental officers as being an outstanding success. Columbia, capital of South Carolina, is not a large city, having a population of approximately 100,000. The first market in the centre of the city originated as a "kerb" market and eventually extended along one street for several city blocks. The facilities were described as antiquated, most of them makeshift, which meant huge losses in handling and spoilage. Space was not available for adequate refrigeration and traffic was greatly congested.

Plate 3.

Columbia Wholesale Fruit and Vegetable Markets.

South Carolina, realising the need for a State system of farmers' markets, set up, by Act of the General Assembly in 1948, a State Agricultural Marketing Commission. The Commissioner of Agriculture (elected Head of the Department of Agriculture) was appointed Chairman of the Commission and the other six members were respectively a retail grocer, a farmer producing livestock, a poultry and egg producer, a wholesale produce dealer (market agent), a fruit and vegetable producer and the President of Clemison Land Grant College of Agriculture.

In 1951, the State Government and the municipal authorities of Columbia having agreed, the entire market was moved to a new location adjacent to a State highway at a point about two miles from the centre of the city. The market was placed on an area of 50 acres of land, using 30 acres and holding 20 acres in reserve.

Plate 4.

Farmers' Stalls at Columbia Food Terminal.

The area is larger than would be warranted for a city the size of Columbia. The formula of the U.S.D.A. Transport and Facilities Branch for determining size of market area is 10 acres per 100,000 of population. However, Columbia, located midway between New York and Miami, is a natural distribution point for the southeast and therefore this market does a large business with other towns. It is to a great extent a truckers' market.

The facilities include 61 merchant store units (96 ft. x 22½ ft), 127 farmers' and truckers' stalls, a service station, a restaurant and a barber shop. Rail facilities owned by the market are adjacent to 36 of the merchant store units and include spare siding accommodation.

A feature of the market is its ample parking space.

Upon the removal of the market to the new site, which is land owned by the State Government, the City Council by Ordinance closed the old market and relinquished its control of the market to the State Agricultural Marketing Commission. The latter employs a State Marketing Director and has appointed a Manager to manage the new Columbia market. The physical properties erected on the market site are owned by the State Government and are leased to market operators. The lessees have invested approximately 300,000 dollars in refrigeration units and mechanical equipment. In 1952 the market did over 16 million dollars' worth of business. The market is provided with a market news service by leased wire direct from U.S.D.A.

Plate 5.

Road Transports at the Columbia Wholesale Fruit and Vegetable Market.

Finance for the buildings and other improvements was obtained as follows:—

	Dollars.
A State Government appropriation of	100,000
The City provided	50,000
The County provided	50,000
The State Government then matched the City and the County contributions with another	100,000
	300,000
Bonds were sold, repayable over 25 years out of market revenue with an interest rate of 2·6%, for	650,000
Making a total of ..	950,000

Buoyant business in the market has enabled it to repay 32,000 dollars over and above its contractual arrangements in the first three years of operations.

[TO BE CONTINUED.]

Report on the Queensland Random Sample Poultry Production Trial, 1954–55

By J. S. F. BARKER* and H. W. BURTON, Division of Animal Industry.

Random sample trials were first designed by Hagedoorn in Holland in 1927, but these trials did not last. The first such trial to be undertaken since then was in California in 1947, and subsequently, these trials have become popular.

The trials are valuable in that they provide the buyer of chickens or breeding stock with information on the actual worth of the flock from which chickens, &c., are offered for sale. They also show the breeder what the weaknesses are in his stock and his position in relation to other breeders.

CONDUCTING THE TRIAL.

The first random sample poultry production trial in Queensland began in August 1954 at the Poultry Section of the Department of Agriculture and Stock's Animal Husbandry Research Farm at Rocklea.

Selection of Entrants.

As only eight pens were available at Rocklea, only registered stock suppliers who hatched for sale a minimum of 5,000 chickens of a pure breed were eligible to enter the trial. Twenty-five applications were received and these were reduced to eight by ballot.

Incubation and Hatching.

A sample of 150 hatching eggs was selected at random from the hatching trays of each of the eight entrants. One tray of 144 of each sample of eggs was then set in a forced-draught incubator (capacity 4,000) at Rocklea, the position of each tray being determined by ballot. Fumigation of the machine was carried out before setting, using 4½ fl. oz. of formalin and 3 oz. of potassium permanganate crystals per 100 cu. ft. of incubator; then at one-third this rate six hours after the eggs were set; and again on the 18th day, when the eggs had been transferred to the hatching compartment.

Eggs were candled at the 5th and 18th days, all clears and eggs with dead embryos being removed and examined by a veterinary pathologist at the Animal Research Institute, Yeerongpilly. It was possible then to differentiate the clears into infertile eggs and eggs in which the embryo died before development of the blood vessels had commenced.

Rearing.

At hatching, all crippled or otherwise unfit chicks were discarded in accordance with commercial hatchery practice. The sex of the remaining chickens was then determined. Only the pullet chickens were retained; these were toe-marked according to their origin and placed in battery brooders. At seven days of age, the chicks were debeaked, wing-banded and vaccinated by the follicular method with pigeon pox vaccine. After remaining in the battery brooders for three weeks, the young pullets were transferred to open-fronted intensive houses, where they remained for the duration of the trial.

At 10 weeks of age, those groups containing more than 45 pullets were reduced to this number by random selection. At 18 weeks of age, the

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number per entry was further reduced to 30, and these constituted the sample for the laying period of 48 weeks.

Feeding.

All-mash rations were fed throughout the course of the trial. The chick starter mash was fed from hatching to eight weeks of age; the growing mash from eight weeks to 18 weeks of age; and the laying mash from then to the end of the trial. The composition of these three mashes is set out in Table 1.

mash was begun when the chickens were transferred from the brooders to the intensive pens. This was continued until the chicks were 12 weeks of age.

Method of Scoring.

Points were allotted for the following four economic factors:—

(*a*) Hatchability of eggs.

(*b*) Rearability of chickens to 18 weeks of age when the production test commenced.

(*c*) Egg production.

TABLE 1.

Composition of Rations Fed During the Trial.

Ingredient.	Ration.		
	All-Mash Chick Starter Ration.	All-Mash Growing Ration.	All-Mash Laying Ration.
	lb.	lb.	lb.
Bran	20	25	25
Pollard	20	14·5	20
Sorghum meal	21·5	23	20
Maizemeal	20	15	15
Wheatmeal	..	11	6
Meatmeal	7	6	6
Livermeal	3	3	3·5
Buttermilk powder	8	2	..
Salt premix*	0·5	0·5	0·5
	100	100	100

* Salt premix consisted of 10 lb. salt to which was added 80 grams of manganese sulphate and 2·6 grams of synthetic riboflavin.

A fish-oil emulsion containing 5,000 I.U. of vitamin A and 500 I.U. of vitamin D_3 per gram was added to all the mashes at the rate of 2 fl. oz. per 100 lb. mash.

The rations were fed in unrestricted amounts in open feed hoppers, and from the age of four weeks onwards shell grit and insoluble grit were made freely available.

In order to reduce the possibility of an outbreak of intestinal or caecal coccidiosis, which could have affected some groups more severely than others, feeding of sulphaquinoxaline powder at the rate of 0·0125 per cent. in the

(*d*) Livability of pullets during the 48 weeks of the production section of the trial.

The number of possible points is based on an arbitrary judgment of the relative economic worth of the various characteristics. The point scoring system was as follows:—

Hatchability.—Five points were awarded for each 1 per cent. of eggs set that hatched. The maximum points were 500.

Rearability.—Four points were awarded for each 1 per cent. (but not part thereof) of chickens hatched that were

reared up to the age of 10 weeks, and six points for each 1 per cent. (but not part thereof) of 10-week-old chickens that were reared up to age of 18 weeks.

Pullets removed from a group because they were considered a disease risk were regarded as a rearing loss. Those removed because of accidental maiming or killing, incorrect sexing or group reduction by random selection were not regarded as rearing losses. The rearability from 10 weeks to 18 weeks of age was calculated as a percentage of the number of pullets remaining in each group after the random reduction at 10 weeks of age. The maximum points were 1,000.

Egg Production.—The bulk weight of all eggs laid was taken daily during a 48-week production trial which commenced when the groups were 18 weeks of age and one point was awarded for each 2 oz. of egg weight produced. Soft-shelled eggs were not considered. The actual number of eggs laid by each group was recorded but points were awarded solely on bulk weight.

Livability.—Points were awarded as shown in the following scale, according to the number of pullets in a group still alive at the conclusion of the trial:—

Number of Survivors.	Points.
30	1,000
29	950
28	890
27	820
26	740
25	650
24	550
23	440
22	320
21	190
20	50

If less than 20 survived no points were awarded for livability.

RESULTS AND DISCUSSION.

The results of this trial are shown in Tables 2-6.

Hatchability.

In Table 2, showing the hatchability results, it can be seen that overall fertility was good, 85.42 per cent being the lowest recorded. Group F had only average fertility. However, it had the highest hatchability, as there were few dead embryos and very few failed to hatch. It is interesting to note that, while the White Leghorns had the higher average fertility, their average hatchability was lower than that of the Australorp groups.

Rearability.

Table 3 shows the rearability scores. Group C, with 996 points out of a possible 1,000, had the best rearability results. Overall rearability to 18 weeks was very good. However, this is probably a reflection of the fact that the birds in this trial were housed in new pens. The exposure to disease was thus low. It may be expected that in future trials the rearability will not be so high.

Egg Production.

The table of egg production (Table 4) shows not only the total equivalent 2 oz. eggs on which scoring is based, but the total number of eggs laid by each group, the average weight of all eggs, the percentage mortality and the hen housed average. Group F had the highest score for egg production, and in addition laid most eggs and had the highest hen housed average. The Australorp groups averaged over 700 eggs more per group than the White Leghorn groups.

Summary of Score.

Table 5 summarises the scores for the four characteristics and gives the total score. It can be seen that the

TABLE 2.

NUMBER OF EGGS HATCHED AND HATCHABILITY SCORE.

Group Number.	Breed.	*Number of fertile eggs.	Percentage fertile.	Number of dead embryos.	Number failed to hatch.	Number hatched.	Percentage hatched.	Hatchability Score.
A1 ..	White Leghorn	138	95·83	16	10	112	77·78	385
B1 ..	White Leghorn	129	89·58	8	14	107	74·31	370
C1 ..	Australorp	139	96·53	20	11	108	75·00	375
D1 ..	White Leghorn	140	97·22	21	17	102	70·83	350
E1 ..	Australorp	141	97·92	19	11	111	77·08	385
F1 ..	Australorp	136	94·44	14	3	119	82·64	410
G1 ..	White Leghorn	138	95·83	17	21	100	69·44	345
H1 ..	Australorp	123	85·42	17	8	98	68·06	340
Averages	White Leghorn ..	..	94·62	15·5	15·5	..	73·09	362·5
	Australorp	..	93·58	17·5	8·25	..	75·70	377·5
	Overall	..	94·10	16·5	11·875	..	74·39	370·0

* 144 eggs set for each group.

TABLE 3.

REARING PERCENTAGES AND REARABILITY SCORE.

Group Number.	Breed.	Number of pullets placed in brooder.	Percentage reared to 10 weeks.	Rearing score to 10 weeks.	Number of pullets retained at 10 weeks.	Percentage reared 10-18 weeks.	Rearing score 10–18 weeks.	Total rearability score.
A1 ..	White Leghorn	63	96·1	384	45	97·8	582	866
B1 ..	White Leghorn	53	98·1	392	45	100·0	600	992
C1 ..	Australorp	55	99·1	396	45	100·0	600	996
D1 ..	White Leghorn	40	92·7	368	38	100·0	600	968
E1 ..	Australorp	50	92·2	368	45	100·0	600	968
F1 ..	Australorp	50	95·1	380	45	100·0	600	980
G1 ..	White Leghorn	49	94·1	376	45	97·8	582	958
H1 ..	Australorp	44	88·2	352	41	97·6	582	934
Averages	White Leghorn ..	..	95·25	380	..	98·9	591·0	971·0
	Australorp	..	93·65	374	..	99·4	595·5	969·5
	Overall	..	94·45	377	..	99·15	593·25	970·25

TABLE 4.

EGG PRODUCTION.

Group Number.	Breed.	Total Number eggs laid.	Percentage mortality during egg-laying period.	Hen Housed Average.	Bulk egg weight.	Average weight, all eggs.	Total equivalent 2 oz. eggs.	Egg Production Score.
					lb. oz.	oz.		
A1 ..	White Leghorn ..	4,857	20·00	161·9	613 2·48	2·02	4,905·23	4,905
B1 ..	White Leghorn ..	4,864	13·33	162·1	648 6·90	2·13	5,187·44	5,187
C1 ..	Australorp	5,569	6·67	185·6	691 12·17	1·99	5,534·09	5,534
D1 ..	White Leghorn ..	4,004	16·67	133·5	533 5·49	2·13	4,266·76	4,266
E1 ..	Australorp	5,667	3·33	188·9	711 15·71	2·01	5,695·87	5,695
F1 ..	Australorp	5,898	0·00	196·6	767 8·04	2·08	6,140·04	6,140
G1 ..	White Leghorn ..	5,550	0·00	185·0	728 4·58	2·10	5,826·30	5,826
H1 ..	Australorp	5,268	3·33	175·6	713 3·92	2·17	5,705·97	5,705
Averages	White Leghorn ..	4,818·75	12·50	160·63	630 12·86	2·10	5,046·43	5,046·00
	Australorp	5,600·50	3·33	186·68	721 1·96	2·06	5,768·99	5,768·50
	Overall	5,209·63	7·91	173·65	675 15·41	2·08	5,407·71	5,407·25

TABLE 5.

TOTAL SCORE AND ITS COMPONENTS.

Group Number.	Breed.	Hatchability score.	Rearability score.	Egg Production score.	Livability score.	Total score.
A1 ..	White Leghorn	385	966	4,905	550	6,806
B1 ..	White Leghorn	370	992	5,187	740	7,289
C1 ..	Australorp	375	996	5,534	890	7,795
D1 ..	White Leghorn	350	968	4,266	650	6,234
E1 ..	Australorp	385	968	5,695	950	7,998
F1 ..	Australorp	410	980	6,140	1,000	8,530
G1 ..	White Leghorn	345	958	5,826	1,000	8,129
H1 ..	Australorp	340	934	5,705	950	7,929
	Maximum Possible Score	500	1,000	..	1,000	..
Averages ..	White Leghorn ..	362·5	971·00	5,046·00	735·00	7,114·50
	Australorp	377·5	969·50	5,768·50	947·50	8,063·00
	Overall	370·0	970·25	5,407·25	841·25	7,588·75

TABLE 6.

FEED CONSUMPTION.

Group Number.	Breed.	Number of eggs laid.	Total equivalent 2 oz. eggs.	Weight of feed consumed.	Weight of feed per dozen eggs.	Weight of feed per dozen equivalent 2 oz. eggs.
				lb.	lb.	lb.
A1 ..	White Leghorn	4,857	4,905·23	2,338·85	5·78	5·72
B1 ..	White Leghorn	4,864	5,187·44	2,558·27	6·31	5·92
C1 ..	Australorp	5,569	5,534·09	2,583·51	5·57	5·60
D1 ..	White Leghorn	4,004	4,266·76	2,340·56	7·01	6·58
E1 ..	Australorp	5,667	5,695·87	2,563·12	5·43	5·40
F1 ..	Australorp	5,898	6,140·04	2,829·18	5·76	5·53
G1 ..	White Leghorn	5,550	5,826·30	2,718·36	5·88	5·60
H1 ..	Australorp	5,268	5,705·97	2,677·18	6·10	5·63
Average ..	White Leghorn ..	..	..	2,489·01	6·25	5·69
	Australorp	..	..	2,663·25	5·72	5·54
	Overall	..	..	2,576·13	5·98	5·75

Australorp Group F has the highest total score. This group scored the highest for hatchability and egg production, and equal highest for adult livability, while it was third highest for rearability. Group G, the highest scorer of the White Leghorn groups, was second highest of all groups. On the average, the Australorp groups were higher than the White Leghorns for all economic factors except rearability.

Other Records.

Various other records, which do not contribute to the total score, have been kept and are of interest.

The feed consumptions of the groups during the 48-week laying period are shown in Table 6.

On the basis of the weight of feed consumed during the production period per dozen equivalent 2 oz. eggs (that is, 24 oz. of egg weight) produced, Group E was the most economical producer. Group F, the highest scorer in the trial, was equal second with Group G in economy of feed use. On the average, the Australorp groups were more economical than the White Leghorn groups.

During the course of the trial, quite a number of birds became broody. They were placed in a broody coop for four days, then put back on the floor. Of the Australorp groups, Group C had the most broodies, having four birds broody once, two twice, and one three times. Group E had three broodies, Group H two, and Group F one. Of the White Leghorn groups, Group D had two broodies and Group A one.

The mortality from hatching to the end of the trial is shown in Plate 1. Although the total number of birds involved is not large and the losses relatively low, this figure does indicate the times when mortality is most likely to occur. These are in the first three weeks after hatching, during the early egg production period, and towards the end of the first laying year.

The average number of eggs per group per week has been calculated separately for the two breeds entered in this trial. Similarly, the average weight of eggs per group per week (in ounces) and the average weight of feed consumed per group per week

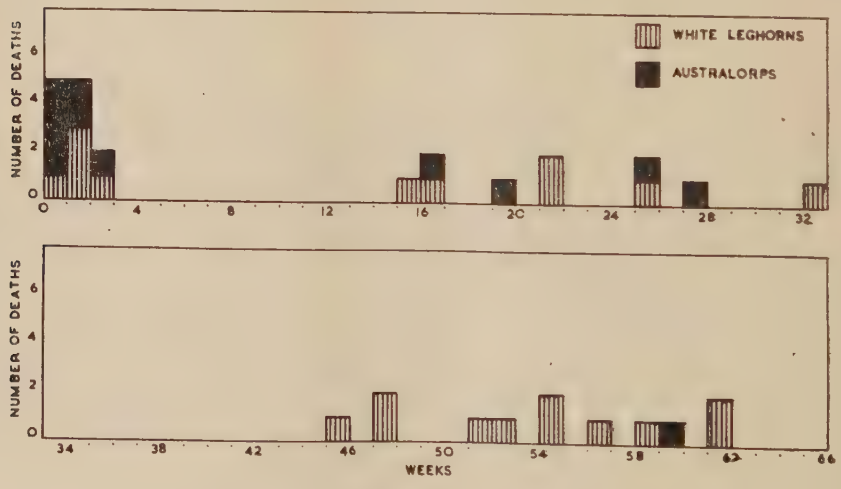

Plate 1.

Total Mortality from Hatching to the End of the 48-Week Laying Period for Australorp and White Leghorn Pullets.

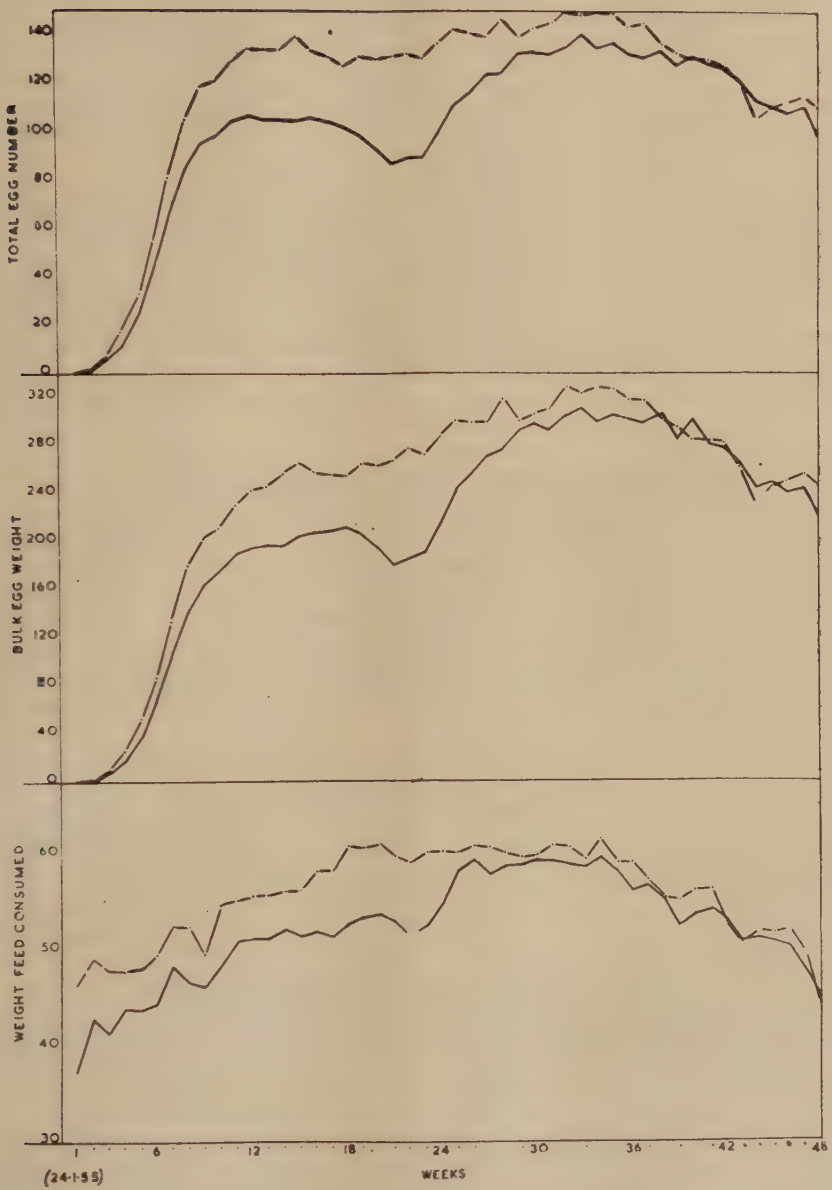

Plate 2.

Average Total Egg Number Per Group, Average Bulk Egg Weight Per Group, and Average Weight of Feed Consumed Per Group for the Australorp (broken line) and White Leghorn (unbroken line) Groups During the 48-Week Laying Period.

(in pounds) have been calculated. These results are shown graphically in Fig. 2.

It can be seen that egg production rose rapidly from 18 weeks of age to nine weeks later (that is, to 28/3/55). The White Leghorns reached a production peak in 12 weeks after the beginning of the laying stage (18/4/55) and then declined in production to the 21st week (20/6/55). The Australorp groups reached a production peak in 15 weeks after the beginning of the laying stage (9/5/55) and then maintained their production level to the 21st week (20/6/55). Production again rose in both breeds to reach a maximum at about the 33rd week (12/9/55), after which it declined to the end of the trial. For each breed, total egg number, bulk egg weight and weight of feed consumed all followed similar trends throughout the 48 weeks.

Although this is the first random sample trial to be conducted in Queensland, it can be seen from the results that these trials will provide valuable information for both the breeder and the buyer of breeding stock.

COMPETITION IN CANARY SEED EXPORTS.

The outlook for Queensland canary seed growers this season is not as bright as it has been over the last two years.

The Marketing Division of the Department of Agriculture and Stock advises that world markets will probably be heavily supplied this year. This follows on two seasons of relative scarcity and high prices caused by partial failures of the crop in Morocco, which is the world's largest exporter.

There are indications that the Moroccan crop will be only slightly below normal this year, and sowings are reported to be abnormally heavy in Turkey and Holland. Turkey is a major exporter, but Holland has only recently entered the canary seed market.

Whether or not Queensland can, in times of heavy supply, hold the share of the world market she has claimed over the last two years depends largely on the quality of the seed offered.

Importers contend that Queensland seed is inferior to that of other exporters. If quality could be improved, there is little doubt that Queensland could secure a permanent share of the market, as she has a 10 per cent. duty advantage over other exporters in the United Kingdom, which is the main importer.

BUFFEL GRASS SEED CERTIFICATION.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) announced recently that under the provisions of "*The Agricultural Standards Act of* 1952," he had taken the necessary step to appoint a Pasture Seed Certification Sub-committee consisting of Departmental officers associated with the development of grasses and pasture legumes.

It was becoming increasingly recognised that pastures were the State's most important crop, stated Mr. Collins, and this was resulting in greatly increased demands for pasture seeds. It was therefore of the utmost importance that supplies of good quality seed be available, and seed certification would help to ensure the supply of reliable seed.

Since buffel grass had become the most sought after grass in Queensland because of its high potential as a pasture species over a wide range of soil and climatic conditions, demand for seed had outstripped supplies.

It was because of the need to ensure the purity of seed of the two main strains of this grass that it would be the first to receive the attention of the new Pasture Seed Certification Sub-committee, but other grasses and pasture legumes would be included as the scheme developed.

It was further stated by Mr. Collins that an early meeting of the Sub-committee would be held to formulate rules of procedure for producing this seed under certification conditions.

Contour Ditch Irrigation of Pastures

By A. NAGLE, Irrigationist.

BENEFITS FROM IRRIGATED PASTURES.

The increased production of dairy produce from irrigated pastures as compared with that from rain-grown pastures has clearly demonstrated the benefits which can follow the adoption of irrigation for pasture production in Queensland.

The value of irrigated pastures is emphasised in years of recurrent drought but is by no means confined to these years. The elimination of seasonal fluctuations and the stabilisation of high year-round production are important economic factors and represent perhaps the most striking advantage obtained from irrigated pastures.

Carrying capacity of well-managed irrigated pastures where continuous 24-hour grazing is practised has been from 1½ to 2 dairy cows per acre per annum. Where the area of irrigated pasture is small, grazing may be limited to a few hours daily. The high-protein forage from the irrigated pastures then forms a valuable and nutritious supplement to the available rain-grown pastures and thus appreciably increases production.

A big saving in purchase of concentrates has been effected where dairy cows have had even restricted access to clover-dominant irrigated pastures of high protein value.

PREVIOUS IRRIGATION METHODS.

Pastures have previously been irrigated by the border (flood) and spray or sprinkler methods.

Border irrigation has the advantage of low capital outlay and low labour costs for water application where soil type, slope and topography of the land are suitable for development of this method. Border irrigation is favoured for large areas where a big volume of water is available, as the cost of equipment is limited to that of the pump and power unit. To handle large quantities of water by the spray method a heavy outlay in pipes and spray-line equipment is required.

In addition, for pasture irrigation, large areas can be watered more expeditiously by the border method and night or continuous irrigation offers little practical difficulty. As the watering interval for pastures may need to be reduced to 10 days in midsummer this time factor is important.

However, land with a slope above 2 ft. per chain is not suitable for border irrigation, and on land with uneven topography grading costs would be too high to permit the economic use of this method. Border irrigation is therefore restricted to alluvial land or occasionally to lower scrub slopes where suitable soil types, moderate gradients and regular topography are available.

Spray irrigation may be used for land with irregular topography and for a wide range of soil types, including open permeable soils. Heavy impermeable soils are not well suited for this method of water application.

Where the spray method is used, a high capital outlay is needed for purchase of main and spray lines.

In addition, the time and labour required to move spray-lines impose a heavy strain on the already limited manpower on most Queensland farms.

Where spray irrigation is used on steeper slopes, it may be necessary to run small contour furrows at intervals to check runoff and effect better penetration of water into the soil.

ADVANTAGES OF CONTOUR DITCH IRRIGATON.

The "contour" or "contour ditch" irrigation method can be employed for irrigation of pastures on land of uneven topography with slopes of from 2 to 10 per cent. without expensive land preparation. Border irrigation would not be possible under these conditions.

Many of the coastal streams in southern Queensland have a good yearly flow of water but the area of alluvial land suitable for border irrigation is very limited, especially in the higher reaches of these streams. However, a fairly extensive area of sloping land generally occurs in close proximity to the water supply and much of this land is now carrying a pasture based mainly upon paspalum. White clover is of irregular occurrence in this country, and forms a valuable pasture component only in years of well-distributed rainfall.

The application of seasonal or intermittent irrigation to such pastures, even without preliminary cultural treatment, has resulted in greatly increased productivity coupled with a more constant clover content. Where such irrigation is based upon the contour ditch principle, these benefits can be obtained for a very low capital outlay.

Still greater pasture production and more efficient use of irrigation water can be obtained if the existing pasture is cultivated, fertilized and reseeded with recommended pasture species. On slopes of low to moderate soil fertility, excellent pasture has been obtained with good seedbed preparation and the planting of suitable pasture mixtures, coupled with a fertilizing programme and well-timed irrigations.

Quite good results have also been obtained with the sod-seeding of grasses and clovers into overgrazed pastures for contour ditch irrigation.

The increasing interest shown in "water harvesting" may offer another means of general application of the contour ditch method, especially where the water can be gravity-fed to contour ditches below the storage structure.

In areas subject to seasonal flooding, particularly in the upper valleys of streams, high-velocity flood flows regularly remove soil from the alluvial flats or deposit coarse material on them. In such cases, the provision of contour-irrigated pastures on the slopes above flood level provides an excellent insurance against the temporary (or even permanent) loss of good pasture.

SUITABLE SOIL TYPES.

The contour ditch method can be used on a fairly wide range of soil types. Because of the steeper gradients usually involved, contour ditch irrigation can be applied to the more permeable soils which are regarded as unsuitable for irrigation by the border (flood) method.

In coastal and sub-coastal districts, the general pattern of soils of suitable type and gradient for contour ditch irrigation is one ranging from sandy loam to light clay surface soil overlying fairly impermeable clay subsoils. These soils may be of shallow to medium depth, and are of moderate to low fertility.

On the shallow soils, surface waterlogging might be expected following irrigations, but any temporary waterlogging would be corrected by the adequate drainage facilities provided in a contour ditch layout. This is an important feature of the system.

In inland areas also a wide range of soil types is found on slopes adjacent to watercourses. These include the loam and clay loam soils of the brigalow and brigalow-softwood scrubs.

These scrub soils may include a loamy surface soil underlain by clay at a depth of 12-15 in. The deeper soils of this type are usually associated with the higher slopes, while the soil at lower elevations more often ranges from clay loam to clay. Both soil types are fertile and suitable for contour ditch irrigation.

PRINCIPLES OF CONTOUR DITCH IRRIGATION.

Contour ditch irrigation is a method of *controlled* surface application of irrigation water on slopes which are too steep or too uneven for development of border irrigation. The method has been proved suitable for irrigation of pastures on land with slopes of up to 10 per cent.

The general broad principle of contour irrigation is the flowing of water to shallow ditches constructed at intervals of approximately 4-5 ft. vertical fall down the slope. These ditches are constructed sufficiently off the true contour line to give a slight fall in the direction of water flow.

Water is distributed from the top contour ditch to the land immediately below by means of outlets placed in the ditch bank. These outlets can be used to regulate the volume of water applied to the land below. By these means an effective control can be obtained to regulate the rate of water application to suit the pasture requirements for each irrigation.

Each contour ditch may serve as either a watering furrow or a drainage furrow. Thus when a particular bay is being watered, the furrow on its lower side will collect any excess water and redistribute it to the bay immediately below (Plate 9). Wasteful use of water is thereby eliminated.

Distribution and spread of water in its downward movement is more effective by the use of small plough furrows at intervals of 15-20 ft. down the slope. These "spreader" furrows are run on the true contour, and collect

PLAN CONTOUR DITCH LAYOUT.

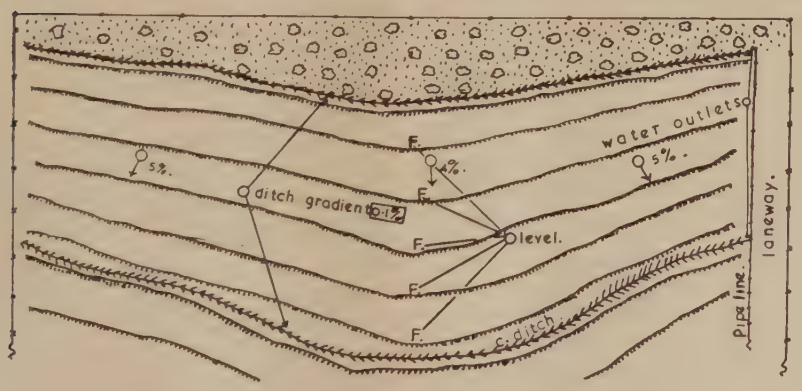

Plate 1.

Plan of Portion of a Contour Ditch Irrigation Layout. This plan shows the top bay of a contour ditch layout on a slope ranging from 4 to 5 per cent. Between the contour ditches (with their supporting banks) are a number of spreader furrows. Water is fed into the ditches from a pipeline on the right-hand side, and a slight ditch gradient is allowed from right to left to carry the water across the field.

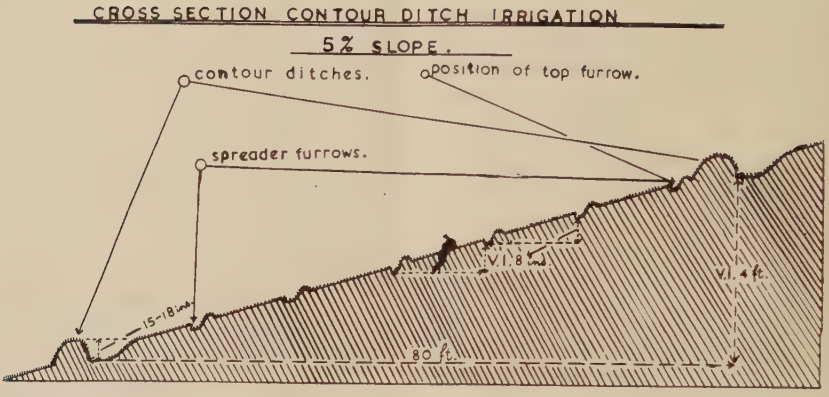

Plate 2.

Cross-section of One Contour Ditch Irrigation Bay on a 5 per cent. Slope. Shown in cross-section are two contour ditch watering furrows with their supporting banks, and six spreader furrows. The top spreader furrow is immediately below the top bank, and serves to spread the water which passes through the bank by means of outlet boxes.

and distribute the water evenly down the slope. The dense sward or ground cover of a well-managed pasture also acts as an effective aid in the even distribution of the water.

The plan and cross-section of a contour ditch layout, shown in Plates 1 and 2, illustrate the above points.

DESIGN OF CONTOUR DITCH LAYOUT.

As contour ditch irrigation is to be used on land with slopes of from 2 to 10 per cent. there is a risk of possible loss of soil from erosion, particularly during the period of pasture establishment. This risk should be minimised by the construction of diversion banks to intercept stormwater runoff from land above the area to be irrigated.

Diversion banks are normally not necessary where the first contour ditch is situated near the crest of the slope.

Grassed waterways should be formed on each side of the irrigation area to intercept and utilise storm runoff water from the field. These grassed waterways can be irrigated from the ends of the contour ditches and should be regarded as an integral part of the pasture area, not as separate drainage projects.

Gradient of Contour Ditches.

Contour ditches should be designed with a very slight fall in the direction in which the water will be required to flow. A gradient of 0·1 per cent., or approximately 1 in. fall per chain, is generally suitable. Where only short ditch lengths are required these could be located on the true contour with no fall in either direction.

For long ditch lengths, it is advantageous to deliver water at the middle of the ditch so that a gradient or flow in two directions can be used. This avoids the necessity of increasing the ditch gradient, as would otherwise be necessary on very long ditch runs.

Steep ditch gradients require the installation of portable or permanent check structures in the ditch to raise the water level in the section from which water is being distributed. These structures add appreciably to the cost of installation. In addition, the continuous attention necessary in the setting of ditch checks as irrigation progresses is wasteful of time and labour.

Size of Contour Ditch.

The size of the ditch is regulated by the water supply available. A ditch 3 ft. 6 in. wide by 6-8 in. deep will satisfactorily carry the discharge from a 4 in. centrifugal pump.

Spreader Furrows.

Spreader furrows (Plate 7) are an effective means of collecting and spreading irrigation water within each bay. They are also a means of reducing velocity of flow on newly planted areas.

Spreader furrows should be spaced about 15-20 ft. apart and should be constructed on true contour lines—that is, they should be level throughout their length. They are constructed with a single-furrow plough and it is important that the furrow slice be thrown uphill, as the collected water can then flow over a clean furrow edge. In surveying the furrow lines, they should be pegged at 33 ft. intervals to ensure that there will be little deviation from the true contour.

Where slight depressions or hollows occur in a field, it is advisable to terminate the furrow short of any such depression and turn the ends of the furrow uphill to hold the water back from the depression. Continuing the furrows into a depression could easily cause overwatering and consequent waterlogging of such an area.

The topmost spreader furrow is formed *immediately below the lower side of the ditch bank* by throwing one furrow back against the bank (Plates 3, 4 and 6). The flow of water from the outlets through the bank is intercepted by this furrow, and an even flow is thus obtained over the top of the section being irrigated.

Ditch Spacing.

The spacing adopted between contour ditches has been based on the somewhat arbitrary figure of a 4-5 ft. vertical interval. This interval was chosen because it had previously been used successfully for construction of contour banks for soil erosion control on slopes of moderate gradient.

On moderate slopes this spacing has proved quite suitable for contour ditches. On the steeper slopes, however, this interval tends to make the bays too narrow and a vertical interval of up to 8-10 ft. may conceivably be adopted.

The dense sward of irrigated pastures acts as a most effective protection for the soil from erosion loss. It not only protects the soil from direct pounding by heavy rain but it also reduces the velocity of both storm water and irrigation water on steep slopes. Therefore, the primary concern in deciding the ultimate spacing of ditches is not so much soil conservation as efficient water distribution.

If a 5 ft. vertical interval were used on a 10 per cent. gradient, the horizontal distance between ditches would be only 50 ft. On a gradient of 2 per cent. the horizontal distance between ditches with the same vertical interval would be 250 ft.

On soils which do not readily absorb water, a horizontal distance of 50 ft. would not give effective watering unless either a small flow of water was used or the flow was continued through to two or more ditches down the slope.

On the other hand, on soils of high water intake a horizontal spacing of 250 ft. could be excessive, resulting in wasteful use of water.

It will readily be seen, therefore, that a consideration of the soil type and its capacity to absorb water is necessary for determination of a contour ditch spacing. Further investigational work and field experience in the application of contour ditch irrigation will be required befor ditch spacings can be precisely set down in relation to slope and associated soil type.

Water Control Outlet Boxes.

Contour ditches are used for conveyance of water through the field, the water being applied to the land below

by means of water control outlets inserted in the bank below the contour ditch (Plates 3 and 4). These outlet boxes are fitted with slides which enable the quantity of water passing through to be controlled.

A spacing of 33 ft. between outlets is usual, but they may be given different spacings to suit the topography of the field. For example, if a contour ditch curves downhill (indicating a high section), this curve is a

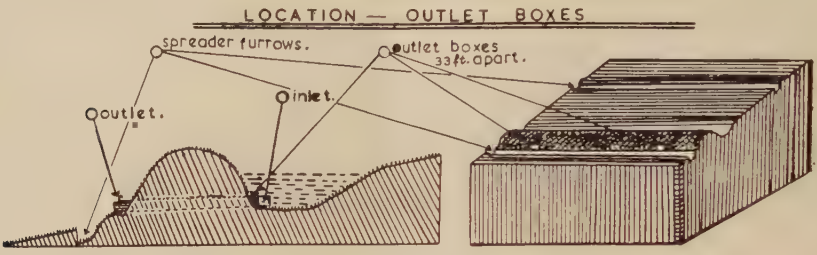

Plate 3.

Two Sections Showing the Location of Outlet Boxes. These boxes, when open, allow water to pass from the contour ditch through the bank into a spreader furrow. The clean lower edge of the spreader furrow allows the water to spread evenly over the bay below.

Plate 4.

Contour Ditch Irrigation at Upper Caboolture. This view was taken along the contour bank, the watering ditch being on the right (upper) side and the spreader furrow on the left (lower) side. Portion of an outlet box can be seen in the foreground.

good position for an outlet box, from the viewpoint of effective water coverage. It is also advisable to place an outlet box at any low spot or built-up section; such outlets will serve most effectively as drainage structures for areas where water would otherwise tend to lie.

The outlet boxes should be set low enough in the bank to take the full flow of water in the ditch (Plate 3).

CONSTRUCTION METHODS.

Only a minimum of construction work is required for contour ditch irrigation, the work being confined to the building of contour ditches, the installation of water control outlets and the forming of level spreader furrows.

For contour ditch irrigation, land grading is quite unnecessary, but a light levelling or "floating" of the land to remove minor surface irregularities is an advantage. This is possible, of course, only where ploughed land is being prepared for the purpose.

Where contour ditch irrigation is to be developed on existing pastures, land smoothing of any sort will not be feasible. In such cases, however, it is important that a strip of land on each of the ditch lines be ploughed and worked to a fine tilth. Effective ditch construction is speedy on prepared soil but is a much lengthier process on undisturbed grassland.

Construction of Ditches.

In forming a contour ditch the soil is moved in one direction only (that is, down the slope), to form a fairly broad mound 3 ft. wide by 10 in. high; the ditch formed should be 3 ft. to 3 ft. 6 in. wide and 6-8 in. deep in the centre.

A two-furrow plough can be used for the construction of the ditches if ploughing is carried out in one direction only. However, it is generally simpler and more effective to use a more specialised implement such as a light grader, a grader-ditcher or a home-made delver. The use of this type of implement usually makes it easier to construct the ditch and bank to the specified cross-section.

DRAINAGE FACILITIES.

The drainage of high-intensity storm rains requires consideration. As has been previously indicated, little runoff normally occurs on a well-established pasture with a good ground cover. In exceptional cases where heavy runoff does occur, each contour ditch will collect and convey this water to one side or both sides of the field. It is therefore desirable to include water disposal facilities in the contour ditch layout.

Grassed Waterways.

Grassed waterways are recommended where practicable for disposal of runoff. These are constructed by forming low mounds 10-15 ft. apart, the space between being carefully levelled and sown to grass. A grader is required for the effective construction of such a waterway. Water from the ends of the ditches is discharged into the waterway, and as water can be applied as required, a good grass cover can be maintained.

There are some conditions under which it may not be possible to provide a continuous waterway—for example, where a grader is not available or where the topography of the land is not suitable for its construction. Where this is so, the area adjoining the point of water discharge from each ditch should be sown with grass to provide an effective cover for the soil. In addition, any surplus water should be conveyed to existing grassland or to a natural depression where it can be utilised by a water-tolerant grass such as para grass.

Water control outlets should be installed at the end of each ditch to facilitate drainage of storm water onto the waterway or other grassland provided.

WATER APPLICATION.

The application of irrigation water to the desired contour ditch will be either by pumping or by gravity flow. Control of the distribution of the water to the bay (or bays) below is by means of the outlet boxes. Each outlet has an adjustable gate which regulates the flow of water through that outlet. Additional control of the application rate may be obtained by varying the number of outlets in use at any one time (Plate 5).

By these means it is possible to regulate the flow in relation to the total volume of water available. This control of the water flow is very necessary to fit in with the particular slope and soil type and to meet the water requirements of the pastures at the time of application.

Where the soil type does not soak up water quickly, or where the slope is fairly steep, it is very necessary to have the water move slowly down the slope. This requires a slow rate of application, which is achieved by having a considerable number of outlets discharging over a relatively wide front.

Where the soils absorb water readily, where the slopes are relatively flat, or where there is a very dense pasture cover, it is necessary to provide a much heavier flow of water. This means that at each operation the full water flow is applied to a smaller area of the pasture and for a shorter period of time. If the application rates are not speeded up under such conditions, a considerable wastage of water will occur, especially on deep porous soils.

Plate 5.

Irrigation Control by Restricting the Length of Irrigating Channel. In this instance a bag stop was used to restrict watering to one section of the paddock. When this section was completed, the outlet boxes on this side of the stop were closed, and the stop removed to a point further along the ditch.

Plate 6.

View of Bank and Spreader Furrow from Immediately Below the Bank. The bank is covered with coarse grass, in contrast with the bays, which are carrying an excellent clover-rich pasture. In the middle of the section of bank is an outlet, but the box is obscured by grasses. Water is flowing gradually from the spreader furrow over the pasture below.

Plate 7.

A Spreader Furrow in the Middle of a Pasture Bay. This furrow is full of water, but is almost obscured by the density of the pasture. It runs from the region of the ironbark tree in the background to a point near the centre of the picture and then swings away towards the left-hand bottom corner.

Plate 8.

The Water Supply for a Contour Irrigated Pasture. In this instance the water is pumped to the pasture along an irrigation pipeline and flowed out onto a bag. The water runs from the bag into the irrigation ditch immediately below.

Plate 9.

Irrigating More than One Bay at One Operation. The contour ditch in this picture is receiving drainage water from the bay above and passing it through the bank on the left to the bay below. The electric fence line in the picture is used to control grazing on the pastures.

Plate 10.

Native Pasture Adjoining the Irrigated Pastures in the Previous Pictures. When photographed during November, 1955, the native pastures were dry and weedy and of very low nutritive value. The irrigated block, in contrast, provided lush, clover-rich pasture of high feed value.

Further control of water application may be obtained by initial design of the spreader furrows. It has been previously stated that these furrows are normally spaced at 15-20 ft. intervals down the slope. However, variation in number and size of these furrows can be used to give some additional regulation of the water flow.

The use of large spreader furrows, closely spaced, would promote greater penetration of the irrigation water. On the other hand, wide spacing of the furrows would tend to lower the water usage. It must be remembered however, that the main purpose of these furrows is to bring about an even spreading of the water over the slope, and the interval should not be increased beyond 25 ft.

A further important and effective control of water application can be gained by means of the main contour ditches themselves. If a quick light application is required, the water can be pumped into each feeder ditch in turn for irrigating one bay at a time. If conditions demand a slow application for effective penetration, the flow may be continued down the slope, covering three or more bays at once. As each ditch has its outlet boxes, the water collecting in the lower ditches will automatically be redistributed to the slopes immediately below.

The contour ditch irrigation method has been clearly demonstrated to give an even coverage coupled with economic water usage, provided (i.) the design has been chosen to meet local requirements, and (ii.) intelligent irrigation practices are employed.

Plate 11.

Portion of a Contour Ditch Irrigated Pasture in the Brisbane Valley. Irrigation water for these pastures is pumped from the dam at the base of the hill and conveyed to the contour ditches by underground main.

Plate 12.

Close-up of Irrigated Pasture in Plate 11. This well-managed pasture shows an excellent blending of phalaris with red and white clovers.

Determination of Application Rate.

To ensure that economic use of water is being obtained, it is important that the rate of application should be known for any particular set of irrigation conditions. This rate can be determined from the volume of water per hour being delivered to the field, the time taken to apply the water, and the total area being irrigated at that time.

The delivery rate can be determined fairly accurately by diverting the full discharge into a tank of known capacity; the time taken to fill the tank can be taken; using the seconds hand of a watch. Using this time, the delivery of water in gallons per hour can easily be calculated. If this figure is multiplied by the number of hours of irrigation, and divided by the number of acres being irrigated, the number of gallons applied per acre is found. As one inch of water applied to an acre of land (that is, 1 acre-inch) is equivalent to approximately 22,700 gallons, the amount of water applied can be readily converted to inches.

If necessary, adjustments in irrigation control can be made on future occasions to increase or decrease the water application to the required rate.

Depth of Moisture Penetration.

As the zone of maximum root penetration is normally the top 12-15 in. of soil, only sufficient water should be applied at each irrigation to wet the soil to that depth.

The depth of water penetration after each irrigation can be determined with reasonable accuracy by the use of a probe. This is a 3 ft. 6 in length of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. round-iron, to which a handle is welded; the end of the rod is left unpointed. The probe is pushed into the soil until firm resistance is met. The depth of penetration, which is measured on the stem of the probe, is used as an indication of the depth of wet soil.

To assess soil moisture before irrigation, an earth auger should be used. Borings made to the depth of effective root penetration show the extent to which the soil has dried out and give a useful guide to irrigation requirements.

Both the probe and the soil auger are essential aids in developing efficient irrigation.

IRRIGATED PASTURE MIXTURES.

With the wide variation in climatic conditions obtaining in Queensland, a comprehensive range of mixtures may be successfully irrigated by the contour ditch method. The final choice of pasture will be determined by the local conditions, the preferences of the farmer, and the requirements of his farm.

The following range of irrigated pasture mixtures is presented as a general guide, but it is recommended that the advisory officers of the Department of Agriculture and Stock be consulted as to the suitability and productivity of these mixtures under local conditions.

Annual Pasture—Winter Production.

	lb. per acre.
Subterranean clover	2
Wimmera ryegrass	4

Addition of the following is optional:—

	lb. per acre.
Lucerne	½-1
Phalaris	1-2

Permanent Pasture.

	lb. per acre.
White clover	2
Red clover	1
H1 ryegrass	2-4
Phalaris	2-3
Cocksfoot	2-3
Paspalum	4-6

(For coastal areas cocksfoot may be omitted.)

Permanent Pasture for Subtropical Coastal Areas.

	lb. per acre.
Paspalum	6-8
White clover	2

Pasture for Wet, Poorly Drained Areas.

	lb. per acre.
Strawberry clover ..	2
Reed canary grass ..	4
or	
Strawberry clover ..	2
Paspalum	6
or	
Strawberry clover ..	2
Para grass—Planted by cuttings.	

Pasture for Intermittent Irrigation.

	lb. per acre.
Lucerne	1
Phalaris	3

Tropical Irrigated Pasture.

	lb. per acre.
Guinea grass	4-5
Centro	2-4
or	
Para grass—Planted by cuttings.	
Centro	2-4

Species for Oversowing or Sod-seeding into Established Paspalum Pasture.

	lb. per acre.
White clover	2
H1 ryegrass	4

PESTS AND DISEASES HANDBOOK.

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The Department of Agriculture and Stock now has available for sale the second edition of Volume III. of the "Queensland Agricultural and Pastoral Handbook," the first edition of which appeared in 1938.

Following a general description of the structure of insects, fungi and bacteria, and a chapter on insecticides and fungicides, the book proceeds with a discussion of the pests and diseases which affect most of the farm and orchard crops grown in Queensland. The insects, fungi and bacteria concerned are described and illustrated, the symptoms of injury detailed, and control measures given.

Among the crops treated are deciduous fruits, citrus, banana, pineapple, papaw and other subtropical fruits, cereals, cotton, tobacco, lucerne, potato, tomato, vegetables, and pastures. There is also a chapter on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for one pound, post free.

Recirculation Cleaning of Milking Machines

By W. C. T. MAJOR, Dairy Technologist.

Recirculation cleaning of dairy factory equipment has been used for some time. Similar principles have been recently adapted to milking machine cleaning.

A cleaning solution can be introduced into the airline of a milking machine in such a way as to prevent the fluid short-circuiting direct to the vacuum pump.

It is then possible to draw this solution along the overhead airline into the airline downdrops. Then, by various special adaptors, the solution can be transferred from the airline downdrops into the milkline system. The solution then enters the teat-cups and flows into the overhead milkline, by way of the inflations, claw tubes, claws, milk rubbers, metal downdrops and sight glasses. It passes along the milkline and can then be discharged from the machine by the releaser.

When desired, the solution issuing from the releaser into the vat (or other container) can be drawn back into the airline and so recirculated through the machine. This procedure can be continued for as long as is deemed necessary to achieve the desired results.

Plate 1.

Type A Tap. The tap is placed in the airline to prevent the solution from flowing direct to the vacuum pump. It is turned 90 degrees during milking to permit normal operation of the plant.

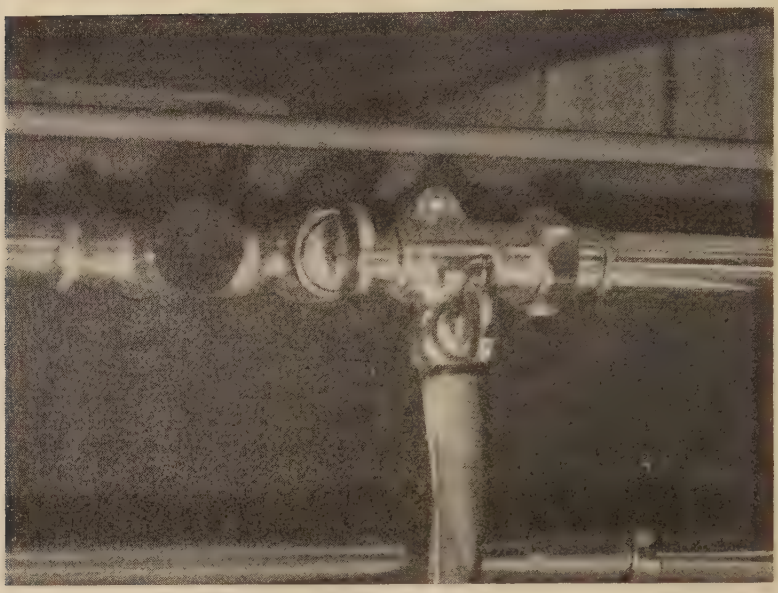

Plate 2.

Type B Tap. The tap is used in the same way as Type A.

I. NECESSARY DEVICES.

Various machinery firms have provided devices to permit recirculation cleaning of the milking machines manufactured by them. The essential devices are:—

(1) A tap, or other device, to control the entry of the cleaning solution into the machine.

(2) An adaptor to transfer the cleaning solution from the airline system to the milkline system.

Plates 1-8 illustrate the devices available in Queensland when these investigations were carried out.

II. METHOD DEVELOPED.

After considerable farm and laboratory research, the following method was developed. It has been found to give satisfactory recirculation cleaning of milking machines. Before starting recirculation cleaning it is essential to thoroughly clean both the milkline and the airline systems. It is also advisable to renew the rubberware.

(1) After Every Milking.

There are four distinct steps which must be carefully followed after every milking—

Step 1.

As each unit finishes milking, brush the outside of each set of cups, and the long and short milk and air rubbers, with a detergent solution at 140 deg. F. and then rinse them with water at 140 deg. F. As soon as all of the units are finished, proceed with Step 2.

Step 2.

Draw water at 110 deg. F. into the airline. It is most important to do this immediately milk flow ceases.

DO NOT PERMIT MILK RESIDUES TO DRY BEFORE WASHING.

DO NOT RECIRCULATE THIS FIRST WATER RINSE.

Flood the releaser as soon as the water runs clear from the releaser. (Either remove the releaser pulsator

tube from the releaser, or set the tap in the appropriate position, or remove the outer flap of the releaser). Then permit air to enter the machine for two minutes. This air causes violent agitation inside the releaser. The scrubbing action produced is necessary to clean the releaser effectively. Then discharge the water from the releaser.

One gallon of water per set of cups will provide adequate flushing. While the water is surging prepare 1 gallon per unit of hot cleaning solution. The temperature of the cleaning solution should be not less than 180 deg. F. when it enters the machine. Bring the solution to the releaser in readiness for Step 3.

Sodium metasilicate is a suitable cleaner when used at the rate of 1 teaspoon (level) per gallon of water. If desired, a wetting agent (such as Teepol, Comprox, Stanvac, Santamerse, Atlantic, Lissapol, etc.) can also be included at the rate of ¼ teaspoon per gallon.

Step 3.

As soon as all of the flushing water has been discharged from the releaser, place the hot cleaning solution (not less than 180 deg. F.) under the releaser and draw the solution into the airline.

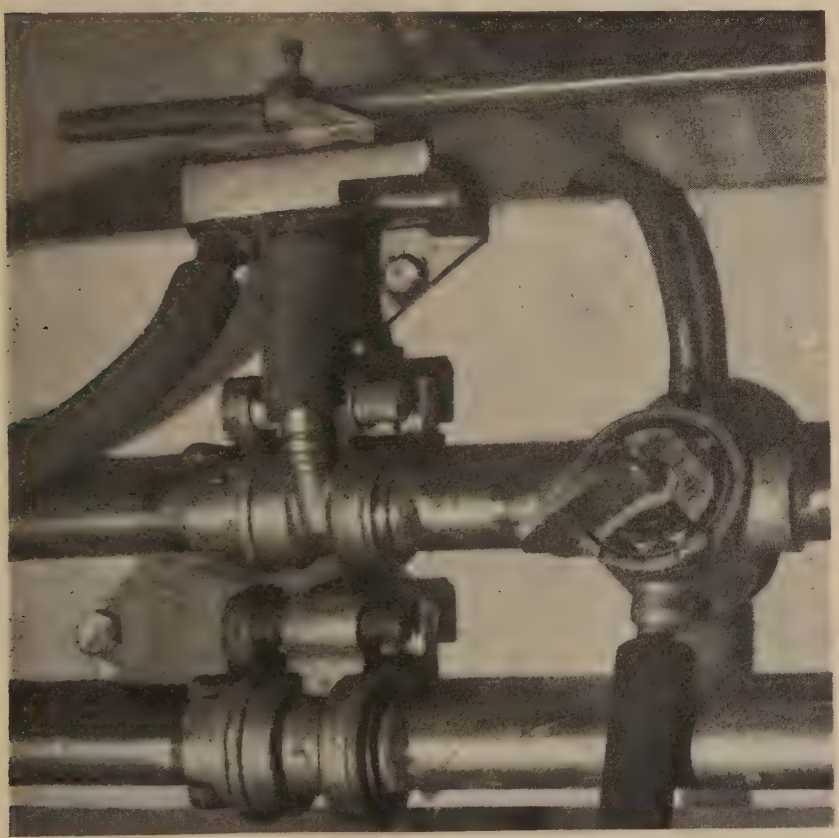

Plate 3.

Type C Tap. This tap is also placed in the airline to prevent the solution from flowing direct to the vacuum tap. The positions for circulation, flushing and milking are indicated on the tap.

Plate 4.

Type A Adaptor. The solution enters the adaptor from the airline system. The adaptor transfers the solution from the airline system to the milkline system.

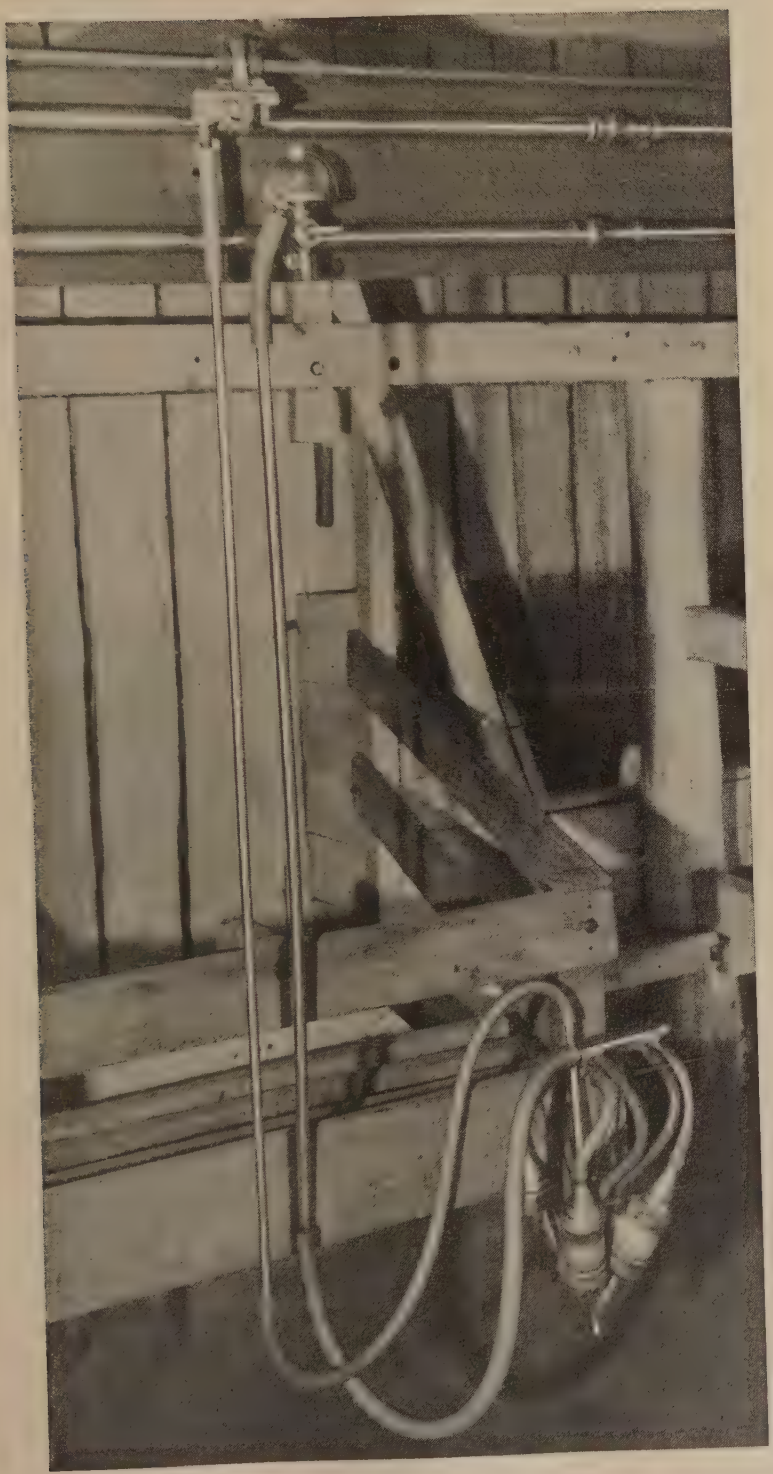

Plate 5.

Type B Adaptor. This type operates in the same way as Type A adaptor.

PERMIT IT TO RECIRCULATE FOR FIVE MINUTES.

Then flood the releaser, admit air and permit it to SURGE FOR TWO MINUTES (as for the plain water in Step 2).

Then discharge the releaser.

While Step 3 is in progress, several convenient small jobs can be done about the building, the last being to bring the final hot water rinse to the releaser. This should be at a temperature of not less than 195 deg. F. One gallon per set of cups will be required.

Step 4.

Draw the hot water (not less than 195 deg. F.) into the airline.

DO NOT RECIRCULATE.

When all of the water has been discharged, remove and empty the vacuum tank. Then dismantle the machine as for the standard method of cleaning. This is given in the Division of Dairying Advisory Leaflet No. 23, which is available from Dairy Officers.

(2) As and When Necessary.

A residue frequently builds up in the pipes and rubber tubes when normal cleaning compounds are used with hard waters in Step 3. Deposits also occur with soft water when insufficient water is used. The amount, nature and rate of build-up of this deposit are influenced by the chemical composition of both the water and the cleaning compound used. Of the various chemical compounds used as cleaners, sodium metasilicate gave the least deposit, whereas washing soda and soda ash gave the most deposit.

It is suggested that the pipes and rubber tubes be carefully observed each day and that they receive special treatment as soon as any residues can be found. Residues may appear in from three days to three weeks—or they may never appear. They are governed by the operating conditions, and these may vary considerably from farm to farm.

(3) Intermittent Treatment.

Perform Steps 1 and 2 as for normal cleaning. Then, using an acid in place of the alkaline cleaner, perform Step 3 as for normal cleaning. Citric, phosphoric or hydrochloric acid may be used at the rate of 1 teaspoon per gallon of hot water.

THE ACID WILL SOFTEN THE DEPOSIT, BUT WILL NOT RINSE IT OUT OF THE MACHINE. IT IS NECESSARY TO BRUSH THE PIPES, ETC., preferably with a nylon-type fibre brush designed to fit the various milking machine tubes and pipes.

Then recirculate an alkaline cleaner as for Step 3. This is necessary to ensure that acid does not remain on the equipment and cause pitting. Then thoroughly brush the pipes, releaser, etc. It will be necessary also to treat the vat, cooler and cans with the acid and alkali and brushing. Then perform Step 4.

III. RESULTS OF CLEANING.

On all of the test farms, the method of recirculation cleaning described in this article produced satisfactory visual cleaning and satisfactory bacteriological rinse counts. Various departures from this method resulted in unsatisfactory visual and bacteriological results. Short cuts did not give satisfactory results. Investigations have shown that in those instances where other farmers have had unsatisfactory results, their method differed from that outlined in this article.

An examination of the bacteriological analysis of the rinses revealed that, before modification to its final form, all recirculation rinse counts were greater than 30,000 colonies per millilitre of rinse water, and many were greater than 300,000 colonies. After modification to its present form, only 16 per cent. of the rinse counts were greater than 30,000 colonies per millilitre.

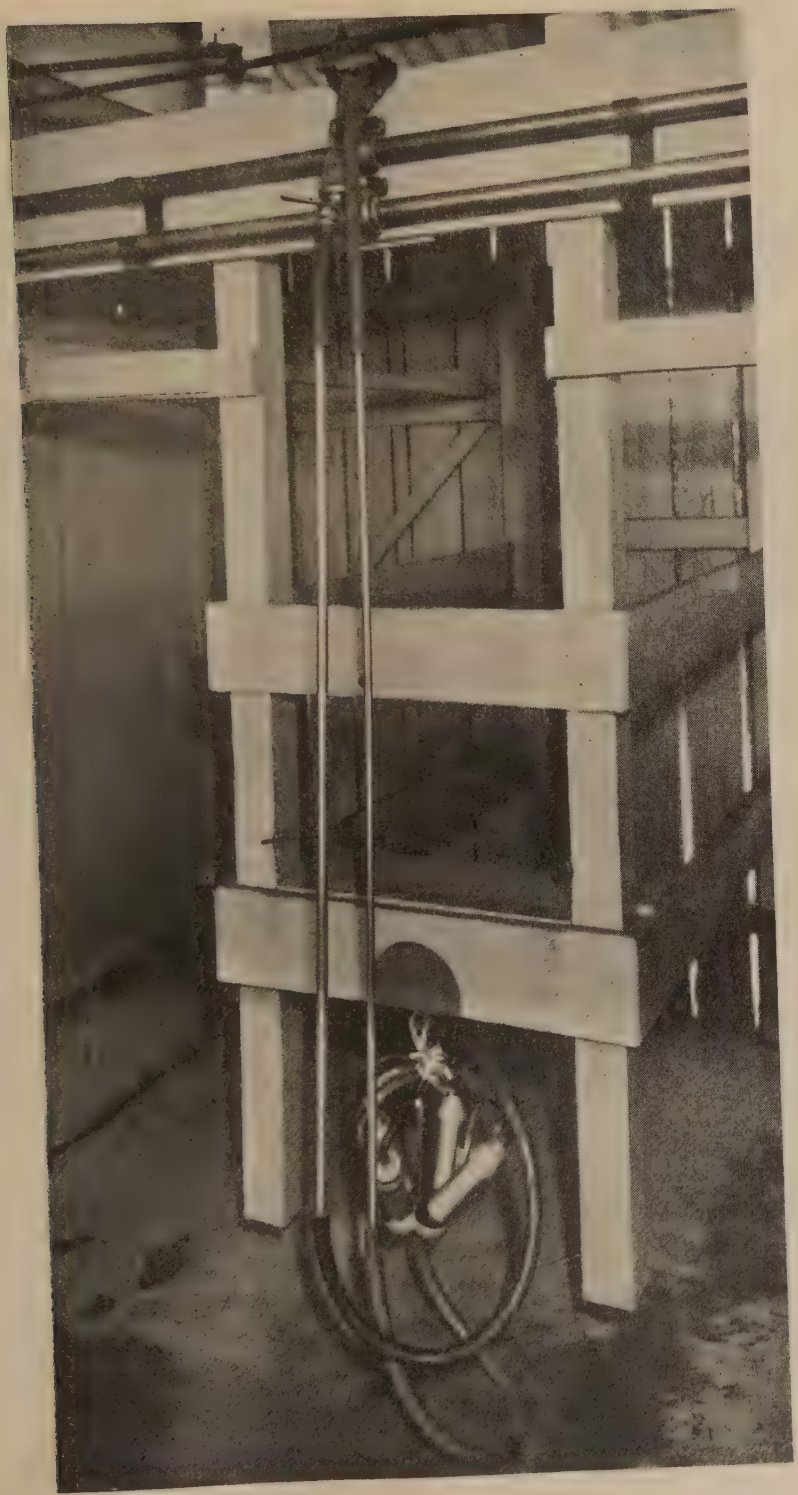

Plate 6.

Type C Adaptor. This has the same function as Types A and B.

Plate 7.

Bails Section of a Milking Shed with Recirculation Cleaning in Progress. The solution passes along the airline system to the adaptor. Here it is transferred to the teat cups, and passes along the milkline system to the releaser shown in Plate 8.

When standard methods of cleaning were used on the same farms, 25 per cent. of the results were greater than 30,000 colonies.

Detailed investigations were made on two farms with very difficult waters which normally rapidly built up deposits. Before the final modifications were made, the rinses following recirculation cleaning were consistently greater than 300,000 colonies per millilitre of rinse. After final modifications the results varied from 300 to 500 colonies.

IV. COMPARISON OF METHODS.

The following is a summary of a comparison of the recirculation method of cleaning, as outlined above, with the standard method of cleaning milking machines as set out in Advisory Leaflet No. 23:—

(1) Both methods consume the same amount of water and chemicals during cleaning and sterilizing.

(2) One trained person can satisfactorily perform either method without assistance.

(3) Neither method gave satisfactory results when short cuts were taken.

(4) Under most Queensland conditions both methods required periodic acid treatment and brushing to keep the plant in a satisfactory condition. Acid treatment is more convenient with recirculation cleaning than it is with the standard method.

(5) With the recirculation method the airline is automatically cleaned during the operation. With the standard method the cleaning of the airline is a separate operation.

(6) Recirculation cleaning takes about 20 per cent. more time (labour) and 20 per cent. more power (electricity, kerosene, dieselene, etc.) than does the standard method.

(7) The interest and depreciation on the recirculation devices used in

these investigations were calculated to be fivepence per day. No devices are required for standard cleaning.

(8) With recirculation cleaning one or other of the rinses (or scrubbings) is cleaning the plant all the time the engine is running. With the standard method only one unit is treated at a time, and for a considerable period the engine is running and the labour unit working, but no actual cleaning is being performed.

(9) While recirculation cleaning is in progress a considerable portion of the operative's time can be profitably employed doing several other shed jobs, such as washing buckets and other dairy utensils, brooming down floors and concrete holding yards, storing cream, etc. When the standard cleaning method is used these duties can only be done after completion of the washing of the milking machine, unless an additional labour unit is employed.

(10) Both standard and recirculation methods of cleaning are capable of producing satisfactory results when correctly applied.

Plate 8.

Releaser Section of the Milking Shed with Recirculation Cleaning in Progress. The solution issues from the releaser into the small vat. From the small vat it is drawn through a rubber tube into the airline to the right of the special tap.

V. CONCLUSION.

Recirculation cleaning is a useful adjunct to the cleaning of milking machines. When correctly used with the appropriate alkaline and acid cleaning compounds, it will permit the plant to be maintained in a satisfactory condition when hard water must be used for cleaning. However, it is not a short-cut cleaning method and those who use it as such will be bitterly disappointed.

The visual and bacteriological results obtained are comparable with those obtained with the standard method when it is supplemented, where necessary, with periodic acid treatment and brushing.

LIVESTOCK IN QUEENSLAND.

The Queensland Government Statistician (Mr. S. E. Solomon) recently issued a bulletin giving preliminary totals of livestock in Queensland at March 31, 1956.

For the fourth successive year, increases were recorded in the total numbers of cattle and sheep, but the number of pigs declined. The number of cattle was the highest ever recorded, and the number of sheep was the highest for 12 years.

The preliminary figures are as follows:—

	South.	*Central.*	*North.*	*Total.*
Dairy Cattle ..	1,091,000	213,000	78,000	1,382,000
Beef Cattle ..	1,696,000	2,086,000	2,157,000	5,939,000
Total Cattle ..	2,787,000	2,299,000	2,235,000	7,321,000
Sheep	12,205,000	7,215,000	2,552,000	21,972,000
Pigs	309,000	48,000	17,000	374,000

MILK SUPPLY TO THE SEPARATOR.

A section dealing with this subject was included in the article on cream separators which appeared in the June issue of the journal.

It has recently been found that while a $\frac{3}{8}$ in. I.D. tap and gooseneck is large enough to feed at a rate higher than 120 gallons per hour to a separator, the last eight gallons flows from the vat at the rate of 102 g.p.h. This causes a 120 g.p.h. separator bowl to be "starved", the milk is over-separated and thick cream forms in the cream spout. It has been found that separators over 80 g.p.h. should be fed through a $\frac{3}{4}$ in. I.D. tap and gooseneck. The float can control the flow from a tube of this size when the vat is full, and the last eight gallons of milk are delivered to the separator at the rate of 117 g.p.h.

The rule is that the float should be large enough to hold back the milk (particularly when the vat is full) to the correct separator capacity, and the tap and gooseneck should be large enough in inside diameter to deliver the last of the milk from the vat at the correct rate.

A SPECIAL RADIO SERVICE FOR FARMERS

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THE COUNTRY HOUR, a special service for farmers, is broadcast DAILY from Monday to Friday through the National and Regional Stations from 12 to 1.

The Cream Separator as Used on Dairy Farms in Queensland

By J. D. ELRINGTON, Senior Adviser (Machinery), Division of Dairying.

(*Continued from page 429 of the July issue.*)

VIII. FAULTS IN SEPARATION.

Common troubles associated with cream separation, the possible causes and the remedy are described hereunder.

(1) Unusual Mechanical Noises.

They can be caused by:—

(*a*) *Worn bearings.*—Replace if possible, and attend to the lubrication. If badly worn, a new machine would be required.

(*b*) *Bowl out of balance.*—Have the bowl rebalanced.

(*c*) *Irregular driving power.*—Attend to the engine, countershaft, pulleys, belting.

Occasionally a regular tapping sound is heard even when a new machine is placed in service. This tapping sound only starts when the bowl reaches full speed and is usually heard when the drive is taken through the milking machine vacuum pump. It is caused by the vacuum pump imparting a regular "jerk" to the countershaft. The free-wheeling mechanism in the separator then allows the bowl to run away from the drive momentarily and when the drive catches up with the bowl the "tap" is heard. Separator authorities say that this noise is associated with all engine-driven separators to a greater or lesser degree and will not do the separator any harm. If it appears to be excessive, then the drive should receive attention.

If the countershaft is driven with a belt direct from the engine pulley and the vacuum pump from the other side of the engine this tapping will be minimised if not entirely eliminated.

(2) Cream too Thick.

This can be caused by:—

(*a*) *Cream or milk screw adjustment.*—If the adjusting screw is in the cream outlet, turn it anti-clockwise (out); one-quarter of a turn will reduce the test approximately 2 per cent. If the screw is in the skim-milk outlet, turn it clockwise (in) to make the cream more fluid.

(*b*) *Insufficient milk to the bowl.*—Check the time for separation carefully and the quantity of the wholemilk separated. This should correspond with the capacity of the separator. The formula is—Capacity of separator in gallons per hour =

$$\frac{\text{Gallons of wholemilk separated} \times 60.}{\text{Time to separate, in minutes.}}$$

If this capacity varies much from the rated capacity of the separator check the separator feed.

(*c*) *Bowl being driven too fast.*—Check the speed, using an accurate watch. Do not rely on the bell.

(*d*) *Wholemilk too cold.*—Heat by the addition of a little boiling water to 90°–100°F. Adjust the cream or milk screw to raise the test and add the same proportion of boiling water each milking. This is a necessary wintertime measure to overcome the problem of small quantities of cold milk being difficult to separate satisfactorily.

(3) Cream too Thin.

This can be caused by:—

(*a*) *Cream or milk screw out of adjustment.*—Screw in the opposite directions to 2 (*a*) above.

(*b*) *Bowl drive not fast enough.*—Check the speed with a watch. Do not rely on the bell.

(*c*) *Bowl too high.*—Adjust.

(*d*) *Too much milk admitted to the bowl.*—Reduce the feed.

(4) Loss of Cream in the Skim-milk.

This can be caused by:—

(*a*) *Bowl drive not fast enough.*—See 3 (*b*) above.

(*b*) *Too much milk admitted to the bowl.*—Reduce the feed.

(*c*) *Bowl out of balance.*—Have the bowl rebalanced.

(*d*) *Worn conical plates, distributor false-top or other internal bowl parts.*—Have the bowl reconditioned.

(*e*) *Cracked cream spout.*—Clean and repair.

(*f*) *Wholemilk too cold when separated.*—Heat by the addition of a small quantity of boiling water to 90°–100°F. Adjust the cream or milk screw to raise the test and add the same proportion of water each milking.

(*g*) *Bowl dirty.*—Dismantle and clean. Strain the milk efficiently.

(5) Leaky Bowl.

This can be caused by:—

(*a*) *Faulty rubber ring.*—Replace.

(*b*) *Loose locating pin or bottom plug in the bowl.*—Do *not* solder, as the balance may be disturbed. Have the bowl reconditioned.

(*c*) *Bowl too low.*—Correct the height adjustment.

(*d*) *Cracked skim-milk spout.*—Clean and solder.

(6) Excessive Bowl Wobble.

This can be caused by:—

(*a*) *Faulty rubber ring.*—Replace with a new one.

(*b*) *Bowl and associated parts badly worn.*—Have the bowl reconditioned.

(*c*) *Bowl riding on the spindle instead of seating correctly.*—Fit a new spindle and have the bowl reconditioned.

(*d*) *Insufficient number of conical discs in the bowl, allowing the bowl to be loose inside.*—Add one or two discs. This

fault is caused by wear on the caulks, or spacing pieces, on the discs. After approximately four extra discs have been added the discs are then too close for efficient separation and a new set of discs is required.

(7) Wholemilk Gushes from the Cream Spout.

This happens because the milk is not going into the bowl. It is caused by—

(*a*) *Gassy milk, due to cows being fed on fresh succulent pasture, when gas bubbles in the bowl form a mechanical barrier to the entry of the milk.*—Extend the feed tube from the milk reservoir (float chamber) so that it reaches well down into the bowl, allowing the gas to escape between the feed tube and the inner wall of the central tube of the bowl.

(*b*) *Trying to force too much milk into the bowl.*—Check the supply of milk to the bowl, and adjust.

(8) Thick Cream Inside the Cream Spout.

This fault indicates over-separation and usually occurs towards the end of separation, when the milk vat is almost empty. Check separator speed and milk supply to the bowl. Tip the supply vat towards the separator when the vat is nearly empty. If it is necessary to break the continuity of separation, turn off the supply of milk and take the power off the separator. Do not let the milk from the last few cows "dribble" into the separator. When ready to re-commence separation, bring the bowl up to speed and turn on the milk tap.

IX. MILK IN RELATION TO SEPARATOR EFFICIENCY.

For correct separation the milk must be:—

(*a*) Free from hair and dirt (that is, efficiently strained).

(*b*) At the correct temperature of 90°F. to 100°F.

(*c*) Thoroughly mixed so that it is of even composition. (Stir frequently with a metal stirrer during separation.)

X. VARIATION IN CREAM TESTS.

(1) Causes.

The butterfat percentage of cream varies for several reasons. Briefly, they are:—

(i.) *Cows.*—Changes in richness of herd milk.

(ii.) *Separator*:—

(*a*) Tampering with cream screw will cause large variations in cream tests.

(*b*) High speed, low rate of milk inflow, and low temperatures increase the test but produce fewer pounds of cream.

(*c*) Low speed, high rate of milk inflow, and high temperature of milk decrease the test but produce more pounds of cream.

(*d*) Lack of smooth running.

(*e*) Unclean separator bowl.

(iii.) *Storage of cream.*—Test may be increased by evaporation of moisture. Pounds of butterfat are unaltered.

(2) How to Prevent Variations.

(*a*) Set the cream screw to deliver the desired richness of cream. The desired richness is outlined in the "Dairy Produce Acts" as as follows:—

> "Cream intended for supply to a butter factory during the months of April to September, inclusive, shall contain not less than thirty-four parts per centum of milk fat, and during the months of October to March, inclusive, not less than thirty-eight parts per centum of milk fat."

(*b*) Once the cream screw has been set, do not meddle with it.

(*c*) Run the separator at each skimming uniformly at the proper speed.

(*d*) Use the correct rate of milk inflow with the milk at the proper temperature—"cow warm."

(*e*) If flushing the separator bowl is the general practice, use the same quantity of warm water or separated milk at each flushing.

(*f*) Make sure the separator bowl is running smoothly.

(*g*) Thoroughly clean the separator after each separation.

(*h*) Cool the cream and store in a refrigerator or cooler.

Although the cream test varies at every milking, the tests recorded by the butter factory on cream delivery days three or four per week would be expected to vary little on each report.

XI. SIZE OF SEPARATOR REQUIRED.

Sooner or later the farmer is faced with the problem of replacing his separator. As the machine should be stopped and cleaned after an hour's continuous use, as well as following each use, the correct size machine is one which will separate all of the milk obtained at one milking in the best time of the year in three-quarters of an hour or less. For example, if the maximum amount of milk at any one milking is 50 gallons, then a 75-gallon machine would suffice.

SUMMARY.

The main features in the operation and care of a cream separator may be summarised as follows:—

(1) Firm and level setting.
(2) Correct lubrication.
(3) Correct drive and speed.
(4) Correct quantity and regular supply of milk to the machine.
(5) Good mechanical condition of the bowl.
(6) Good condition of the tinware.
(7) Correct height of the bowl.
(8) Wholemilk in good condition and at proper temperature for separation.
(9) A separator large enough to treat all the milk in three-quarters of an hour or less.

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The Honey Flora of South-eastern Queensland

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 434 of the July issue.*)

Blue Heliotrope.

Botanical Name.—*Heliotropium amplexicaule* Vahl.

Other Common Names.—Purple-top, turnsole, wild heliotrope, wild verbena.

Other Botanical Names.—*Heliotropium anchusifolium* Poir., *Cochranea anchusifolia* (Poir.) Gürke.

Distinguishing Features.—A low bushy hairy plant having leaves arranged alternately along the branches, with very short or no stalks and small blue flowers on branches at first coiled in a dense bunch but uncoiling as the flowers open (Plate 159).

Description.—This is a compact bushy hairy perennial about 1 ft. high. The leaves are fairly soft, with very short or no stalks, arranged alternately along the branches, about 1-2 in. long and $\frac{1}{4}$-$\frac{1}{2}$ in. wide. The flower bunches are borne at the ends of the branches and are of an unusual type. Each bunch is made up of 3-5 branchlets with the flowers densely arranged on the upper side of each branchlet. At first the branchlets are closely coiled but they gradually uncoil as the flowers open and fade. The flowers are purplish blue with a yellow eye, about $\frac{1}{4}$ in. across, each with five small green sepals and five petals partly joined to form a narrow funnel, inside which five tiny anthers are fixed.

Distribution.—A widely spread weed, chiefly along roadsides or in cultivation paddocks. It is a native of South America.

Usual Flowering Time—November-March, occasionally as early as July.

Colour of Honey—Dark amber.

Importance as Source of Honey—Medium.

Importance as Source of Pollen—Medium.

General:—In the Darling Downs District blue heliotrope flowers regularly and is worked heavily by bees for nectar and pollen.

The honey, which is light coloured when first extracted, quickly becomes dark amber after passing through pinkish and reddish stages. Initially, it has a fair flavour, but with a tendency to ferment a "sourness" soon develops. Granulation is slow and with a coarse, sometimes pinkish or reddish tinted grain.

Blue heliotrope honey is unsuitable for blending with lighter coloured honeys and is used principally for manufacturing purposes.

Plate 159.

Blue Heliotrope (Heliotropium amplexicaule). Branch with leaves and flowers.

[TO BE CONTINUED.]